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JIANGSU AGRICULTURAL GEOGRAPHY

Nanjing JIANGSU NONGYE DILI [AGRICULTURAL GEOGRAPHY OF JIANGSU] in Chinese Jun 79 pp 1-6, 1-4, 1-94, 166-182

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FOREWORD

Nanjing JIANGSU NONGYE DILI [AGRICULTURAL GEOGRAPHY OF JIANGSU] in Chinese Jun 79 pp 1-4

[Text] Jiangsu Province is located in East China on the lower reaches of the Chang Jiang, the Huai He, the Yi He, and the Mu He. It faces the Yellow Sea to the east, is contiguous with Shanghai, connects with Anhui to the west, neighbors Zhejiang to the south, and borders Shandong to the north. It has an area of 102,600 square kilometers, which is 1.07 percent of China's total land area. Its area of cultivated land is almost 70 million mu. Population numbers 58.34 million of which the farming population is 51.06 million (all figures being 1978 statistics), or 87.5 percent of the province's total population. Cultivated land per member of the farming population averages less than 1.4 mu. It is a province with a large population relative to available land. The province is divided administratively into seven prefectures (Xuzhou, Huaiyin, Yancheng, Yangzhou, Nantong, Zhenjiang, and Suzhou), seven municipalities under provincial government jurisdiction (Nanjing, Wuxi, Xuzhou, Changzhou, Suzhou, Nantong, and Lianyungang), four municipalities under prefectural government jurisdiction (Qingjiang, Yangzhou, Qinzhou, and Zhenjiang), 64 counties (including counties under municipal government jurisdiction), and 1,885 people's communes. In addition, there are 507 state farms and seedling nurseries.

Jiangsu Province is one of the provinces of China with fairly good conditions for agricultural production and where output is fairly high. In output of grain and cotton, in the number of live hogs, and in quantities of commodities tendered the state, the province is one of the frontranking in the country. Since Liberation, tremendous increases have taken place in all major agricultural output norms. A comparison of 1978 with 1949 shows a 1.9 fold increase in grain output, a 17.9 fold increase in output of cotton, and a 4.2 fold increase in quantities of live hogs. Total output value of agriculture during the 1950's showed a 3.9 percent rate of incremental increase. In the 1960's, it was 4.4 percent. After entering the 1970's, total output value for agriculture in 9 years averaged an incremental increase of 6.8 percent. Rather large improvements have occurred in the lives of the broad masses of commune members, and in all rural villages a picture of prosperity has come into being.

Prior to Liberation, however, under the long term oppression of the three great mountains of imperialism, feudalism and bureaucrat-capitalism, farmland water

conservancy fell into disrepair, while natural disasters were frequent. Northern Jiangsu had a disaster virtually every year, and disasters caused by drought; waterlogging were also fairly serious in southern Jiangsu. Throughout the province output dropped with grain yields averaging only 132 jin per mu. Raw materials for light industry, such as cotton, depended largely on imports. Rural villages throughout the province were destitute, and the broad masses of poor and lower-middle peasants groaned in abyssmal misery, bearing a life of hunger and cold.

Following the founding of New China, under the leadership of the Communist Party and Chairman Mao, and under the guidance of Mao Zedong Thought, land reform was instituted throughout the province in 1951. This thoroughly smashed feudal rural production relationships and the peasants divided the land greatly liberating the rural productive forces. Following the development of the movement to agricultural cooperatives, the revolutionary transformation from an individual small scale agricultural economy to a socialist collectively owned agriculture was completed, and peoples communes came into being to promote steady growth in agricultural production. In the course of an overall rise in Jiangsu's agriculture over the past 30 years a tortuous process with ups and downs has also taken place. The period 1949-1955 was a stage in which the province's agricultural growth was fairly rapid. Following the period of revival of the national economy, under the impetus of land reform and agricultural cooperativization, output in agriculture rose very quickly. Thereafter a period of smooth and steady growth ensued. Between 1959 and 1961, as a result of serious natural disasters and shortcomings and mistakes in work, a short period of decline occurred in agricultural production. However, as a result of implementation of an eight character policy of "readjustment, consolidation, replenishment, and improvement" and the "Revised Draft Regulations for Rural People's Commune Work" put forward by the Central Committee, which aroused the socialist enthusiasm of cadres and masses, the hardships occasioned by 3 years of serious natural disasters were surmounted, bringing about the second stage of great growth in agricultural production during the period 1962-1966. Grain, cotton, and live pig output reached all-time highs. During the period 1967-1969, as a result of the disturbance and destruction caused by the ultraleft line of Lin Biao and the "gang of four," the province's agricultural production remained lower than in 1966, lying in a state of virtual stagnation. It was not until after entering the 1970's and following the Northern Regional Agricultural Conference that a new stage of development emerged. In 1978 the province's grain output totaled 45.8 billion jin, an average of 785 jin of grain per person. Cotton output totaled 9.48 milliion dan; oil-bearing crops totaled 6.68 million dan, and live hogs totaled 21.61 million head. Growth in various degrees also took place in forestry, livestock raising, sideline occupations and fisheries. The gross value of agriculture output reached 12.5 billion yuan.

The main reasons for the rapid growth of agriculture in Jiangsu Province have been the following:

Serious attention was paid to farmland capital construction. As early as the 1950's, the province carried out large scale water conservancy construction every year. In addition, to the extent that natural conditions in each area

permitted, the broad masses did small scale farmland water conservancy construction and vigorously developed pump irrigation and drainage, thereby remarkably increasing capabilities to withstand natural disasters. During the 1960's, following the movement to learn from Dazhai in agriculture, the broad masses of cadres and commune members carried forward the spirit of self-reliance and arduous struggle going all out for further farmland capital construction, water control, and soil improvement which were done in combination. They made great efforts at construction so that harvests could be assured despite drought or waterlogging, thus creating farmlands that would produce consistently high yields. Accompanying the thoroughgoing development of the movement to learn from Dazhai in agriculture in the early 1970's, farmland capital construction reached new levels. Control of mountains, control of water, leveling of the land and improvement of the soil were carried out in combination for all around control of mountains, waters, fields, forests, and roads. Subsequent to 1976 farmland capital construction throughout the province continued to advance toward high standards. Further improvements took place in capabilities to withstand droughts and prevent waterlogging with thoroughgoing and permanent cures for flooding of lowlying areas. There was a steady expansion of the 1,000-jin-per-mu fields, and building of "double key link" fields and "ton of grain" fields. This was the beginning of farmland capital construction which brought contiguous tracts under control. The province worked on capital construction projects involving 200 model farmland tracts of from 10,000 mu to almost 20,000 mu in a contiguous area. By 1978, farmlands from which harvests could be assured despite drought or waterlogging, and which produced consistently high yields amounted to 29.7 million mu, or 42.5 percent of the cultivated land area.

Reforms to the system of farming were carried out. Since the founding of the People's Republic, Jiangsu Province has converted drylands to wetlands, waterlogged fields to drylands, xian rice fields to geng rice fields, and implemented intercropping in a reform of its farming system. In the Xu-Huai area, conversion of drylands to wetlands has been done successfully, and throughout the Lixia He region conversion of boggy fields to drylands has been entirely completed. Beginning in the Tai Lake area, through adaptation of general methods to local situations, a diversified triple cropping system has been developed. The traditional system of intercropping has also been further amplified and developed throughout the province. These things have played a remarkable role in making full use of light energy, heat, and soil and water resources, in linking resistance to disasters and increased yields and soil improvements, in planting in accordance with local conditions to change low yields to high yields, and in increasing soil utilization rates. In 1978 the province's multiple cropping indexed reached 199 percent.

Scientific farming was instituted. Ever since Liberation, the level of scientific farming in Jiangsu Province has steadily risen. In order to make every hour count and to get every benefit from the land, vigorous efforts were made to improve low yielding soils with the result that more than half of the low yielding soils were improved in varying degrees. At the same time attention was given to crop rotation in a combination of using the soil and nurturing the soil. In addition, serious attention was given crop breeding and replacement, and to development of the growing of various green manures. Everywhere

stringent efforts were devoted to intensive farming and scientific farming in order to win bumper harvests year after year and high yields crop after crop. For many years mass scientific farming experimental campaigns have been widely launched out of which have emerged a group of peasant scientists who have scored great successes in developing new varieties and in innovating new farming techniques.

Development of industries to support agriculture have brought about a gradual increase in the level of farm mechanization. In 1978 chemical fertilizer use in the province averaged 90 jin per mu of cultivated land (standard quantity); there was 16.6 horsepower per 100 mu of cultivated land provided by farm machines; the area farmed by machinery amounted to 55.6 percent of total cultivated land; and the effectively irrigated area amounted to 69.6 percent of total cultivated land. In this regard, "five small" industries and commune and brigade industries played an outstanding role.

As a result of the development of productivity and the widespread development of the movement of learning from Dazhai in agriculture, a very large number of agriculturally advanced units appeared along both shores of the Huai He and both north and south of the Chang Jiang. From a foundation of many years of investigation and study, Huaxi Production Brigade in Jiangyin County formulated a plan for the high speed development of agricultural production. Throughout the brigade fields were laid out in checkerboard fashion, and drainage and irrigation, plowing, threshing, plant protection, and processing of agricultural byproducts were substantially mechanized. Farming, forestry, livestock raising, sideline occupations, and fishing saw all-around development. Grain yields reached a ton per mu, and income from industrial sideline occupations amounted to more than one-half of the total income from agricultural sideline occupations. Yueqi Commune in Wu County pursued a program of "taking grain as the key link in all around development," as a result of which grain yields per mu were more than "double the key link," and great development took place in economic diversification. This promoted an expansion of collective accumulations and an increase in commune member income. Suqian County pursued large and rapid increases, turning around its production conditions so that a grain-short county which had had for many years to buy grain from the state at a uniform price became a grain-surplus county which provided commodity grain to the state. Simultaneous with performance of a good job in agricultural production and county-operated industry, Wuxi County actively developed commune and brigade industries for all-around development of agriculture-sideline occupations and industry. Through reliance largely on accumulations from commune and brigade industries and local conditions for production, the county went all out in the capital construction of farmlands, substantially mechanizing drainage and irrigation, plowing, plant protection, threshing, and processing of livestock feeds, thereby promoting rapid development of agricultural production. Looked at in terms of the province as a whole, during the past several years development of agricultural production has been characterized by: continued progress on the part of numerous high yield areas for sustained high yields, and numberous laggard areas rousing themselves to work hard. In the Tai Lake area new levels have been steadily attained. The Lixia He area has changed a historical situation of "boggy fields for a thousand years" to become Jiangsu Province's new granary.

The Tong and Yan cotton growing areas have worked hard to win yield yields from both grain and cotton thus making a greater contribution to the country. Numerous communes and brigades in the hilly Zhenyang region have had bumper harvests of forest products and grain so that a new situation has emerged. The northern Huai region, which had formerly had numerous disasters and low yields also got rid of the stigma of eating grain sold back to it by the state at a uniform price in 1973 and achieved self-sufficiency in grain with some surplus. It is now in the process of building a new commodity grain base.

The experience of the past 30 years has made us deeply aware that for a province such as Jiangsu with a relatively dense population in comparison with available cultivated land, development of agricultural production requires both focusing attention on the 70 million mu of cultivated land for vigorous improvement of yields per unit of area, and on the abundant natural resources existing throughout the province for vigorous development of production from forestry, livestock raising, sideline occupations and fishing so that people will work to the full extent of their capabilities and the land will yield to the full extent of its possibilities, making certain that commune member earnings gradually increase. Also necessary is further capital construction of farmlands for steady improvement in the conditions of agricultural production, as well as use of a combination of farming techniques and farm machines to beat a new path for the modernization of the province's agriculture. There is also need for adaptation of general methods to local situations, proper centralization, rationalization of crop patterns, and vigorous building of production bases for all kinds of commodities. Also necessary is a combination of farming, sideline occupations, and industry for high speed development of agricultural production.

China's socialist revolution and socialist construction has now entered a new period of development. Throughout the province the broad masses of the people are in high spirits and have high morale. They are determined that under the correct leadership of the CCP Central Committee headed by Comrade Hua Guofeng, and raising high the great banner of Mao Zedong Thought, they will unite as one, strive for national prosperity, and struggle for high speed development of agriculture and the four modernizations, in order to achieve the overall goals of the new period.

The "Agricultural Geography of Jiangsu" is a component part of the "Agricultural Geography of China" compiled on the instruction of the Chinese Academy of Sciences and the Ministry of Agriculture. This book has a total of 11 chapters with explanations given mostly on the basis of regionality and emphasis going to adaptation of general methods to local situations and rational crop patterns. Natural conditions pertinent to Jiangsu Province's agricultural production and water, soil, and heat resources are analyzed. Explanations are given about the process of development of the province's agricultural production, its characteristics and regionality. The experiences of the broad masses of poor and lower-middle peasants in changing and using nature over a long period of production are summarized, special exposition is given to major problems of agricultural production in the individual agricultural regions, and ways and means of solving these problems are explored. This book is provided as a reference primarily for planning units at the provincial and prefectural levels and for agricultural departments leading agricultural production.

On the happy occasion of the thirtieth anniversary of the founding of the Chinese People's Republic, we solemnly present this book for the thirtieth national anniversary.

Under the guidance and organization of the Jiangsu Provincial Planning Commission, this book has been compiled by the geography department of Nanjing University, the Jiangsu Provincial Geography Institute, the Jiangsu Provincial Academy of Agricultural Sciences, the department dealing with conversion of soil to agricultural purposes, the agricultural economics department, and the horticulture department of the Nanjing Academy of Agricultural Sciences, the Nanjing Soil Institute of the Chinese Academy of Sciences, the geography department of Nanjing Teacher's Training Academy, and the Jiangsu Provincial Institute of Agricultural Mechanization. The Jiangsu Provincial Forestry Bureau and Education Bureau greatly supported the work on the book. In the process of investigation and study, active support and assistance was given by provincial agricultural offices, the Provincial Statistical Bureau, the Provincial Meteorology Bureau, the Provincial Water Conservancy Bureau, and by leading units and quite a few advanced communes in all prefectures and counties. The commission for the compilation of "A Collection of Maps of Jiangsu Province" and related units provided some original maps and photographs for this book, and the Wu County Agricultural Bureau also rendered very great help with this book, for which gratitude is hereby expressed.

Owing to the limitations of the compilers, it has been impossible to avoid certain shortcomings and errors in the book. Readers corrections will be welcomed.

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CHAPTER 1. NATURAL CONDITIONS AND SOIL RESOURCES FOR AGRICULTURE

Nanjing JIANGSU NONGYE DILI [AGRICULTURAL GEOGRAPHY OF JIANGSU] in Chinese Jun 79 pp 1-40

[Text] Jiangsu Province is located in the lower reaches of the Chang Jiang and the Huai He, and faces the Yellow Sea to the east. The terrain is lowlying and flat. The province cuts across three biological and meteorological zones with marked differences between north and south. The soil is complex and varied, and water and soil resources are relatively abundant. As a result of a long period of transformation and use, the condition of natural resources for agricultural production is rather superior; however, there are also some disadvantageous influences and factors that must be further surmounted.

Section 1. Agricultural Landforms

1. Characteristics of Agricultural Landforms and the Process of Their Formation

Jiangsu Province is a part of China's eastern coastal plain. The topography is flat and the plain broad; the area of hilly and mountainous land is slight and differences in elevation are not great. This provides a fine natural foundation for full and equitable use of soil resources, and development of agricultural production through the adaptation of general methods to local situations.

The plain is formed primarily by the delta plain of the Chang Jiang, the plain of the Huang and Huai rivers in northern Jiangsu, and the coastal plain, which account for about 85 percent of the province's total land area (including inland water surfaces). Except for the western part of the Huang He flood plain, where maximum elevation is 45 meters, ground elevation is mostly less than 10 meters, and generally between 2 and 5 meters.* On both sides of the Chang Jiang delta are two large dish shaped depressions that center on Tai Lake and the Lixia He. The terrain is high all around and low in the middle, gently dropping from the edges of the dishes. On the plain are numerous medium and

*Measurements show that 58 percent of the province's total land area is at an elevation of less than 5 meters; 11 percent is between 5 and 10 meters; 7 percent is between 10 and 20 meters, and 4 percent is between 20 and 40 meters.

small depressions with relative differences in elevation of only 2 to 3 meters. Undulations in the micro-relief of the plain give rise to differences in water and soil conditions, which influence agricultural production. Hilly and mountainous areas are very few, accounting for only five percent of the total area. These are distributed mostly in the southwestern part and the northern edge of the province. Around Lake Tai and along the Chang Jiang are scattered some small hills and low hillocks. In addition, between the foothills of low mountains and hills and the plain are scattered the loess downlands of the southwest and the stony downlands of the northeast, which occupy an estimated 10 percent of the total area.

The plains geomorphology of Jiangsu Province has been formed from the silt carried by rivers and built up by the combined forces of the rivers, lakes and the ocean, man-made changes being fairly recent in history. About 6,000 years ago, ocean waters inundated the area in front of the western mountains. The area north and south of the Chang Jiang and the lower reaches of the Huai He were drowned by the waters of the sea at that time, and the mouth of the Chang Jiang and the mouth of the Huai He were near the present day Zhenjiang and Huaiyin prefectures. Because the Chang Jiang has a distant source and a long area of flow, it carried large amounts of silt, which gradually built up two sandspits on the north and south sides beyond the mouth of the Chang Jiang. The spit on the northside is the present day high sandy soil area on the north bank of the river. The spit on the south shore exists today only as a vestige to the south of Danyang and Shazhou, and as the high sandy area to the west of Changshu and Taicang. The two sandspits gradually encircled two sides of the bay, which gradually filled up with silt to form today's Lake Tai Plain and the Lixia He depression. The plain next to the sea was formed 2,000 years ago by alluvium from the Chang Jiang and deposits from the sea. The Huang He flood plain in the Xu-Huai area was formed from a build up of a plain by the sea, followed by large amounts of Huang He flood plain silt being deposited following the struggle by the Huang He to take over the Huai He between 1194 and 1855.

Jiangsu's mountains were basically formed during the period of the Yanshan movement of the earth's crust at the end of the Mesozoic Era after which, as a result of a long period of scouring and erosion, secondary valleys were formed in fault zones and in places where rock strata were comparatively weak. During the Tertiary and Quaternary periods, basalt was ejected to form mesa topography in some areas. At the end of the Quaternary Period a very thick layer of subordinate loess accumulated in the foothills of mountains, which after steady shearing formed into downlands and low hills.

Among the characteristics of modern landforms in the province, man-made landforms are clearly reflected. The paddy fields surrounded by dikes, the network of waterways, the Grand Canal, river embankments, seawalls, and terraced fields are all the result of longterm use and change of nature by working people.

2. Major Types of Agricultural Landforms and an Evaluation of Them

On the basis of geomorphological characteristics, formative factors, materials that form the earth's surface, the effects of human activities, and soil

utilization for agriculture, the agricultural landforms of Jiangsu Province may be divided into the three basic types of plains, downlands, and low hills.

(1) Plains

Plains are the principal agricultural landforms in the province. Inasmuch as the sediment environment and the sources of deposits differ, the broad plains of Jiangsu Province may be divided in terms of regions as the Chang Jiang alluvial plain, the Lake Tai lacustrine and river silt plain, the Lixia He river silt and lacustrine plain, the coastal alluvial plain, the Xu-Huai-Huang flood plain, and the Yi and Shu rivers flood and alluvial plain, making six major plains.

1. The high plain. This is the relatively high mid-portion of the plain where absolute heights range from 5 or 6 meters to more than 40 meters, and where relative heights range from several tens of centimeters to several meters. Distribution is fairly broad, yet the area is not large covering an estimated 20 percent or so of the total plains area. The terrain is fairly high and flat with a slight tilt in all directions. The sections around the edges are slightly undulating following shearing. Surface rivers are rather scarce and drainage conditions fairly good; however, the area is prone to drought. When torrential rains occur, some areas cannot be easily drained and are prone to waterlogging. On the basis of composition of surface material, this area may be divided into sandy soil and loess soil types. The former are in the high sandy soil areas along the north of the Chang Jiang, in the western Xu-Huai areas, and in the Meng He region of southern Jiangsu. The latter are in the Xibei and Jiangyin area of southern Jiangsu, and on the plain between the Tao and Ge lakes.

2. River network plain. This is mostly distributed in the Suzhou and Wuxi areas around Lake Tai and at the edge of the dish in the Lixia He depression. Absolute height of the land surface is 3 to 4 meters. The water networks are close together and in most years one need not worry about either drought or waterlogging. The material from which the area is formed is mostly river and lake silt, which has a fairly high natural fertility.

3. Water network embankment area plain. Absolute heights range from 1.5 to 3.5 meters. In the Lake Tai and Lixia He areas, they are generally below 2 meters, reaching 3.5 meters in the Lake Tai area. Water networks are close together and the surface of the land is frequently lower than the level of the rivers. Runoff water collects extremely readily. It is for this reason that the masses have built dikes around their fields to prevent inundation. Surface material is largely river and lake silt.

4. Marshy plain. This is located mostly in the Lake Tai and Lixia He marshlands. Absolute surface altitudes are as follows: In the Lake Tai area, from 3 to 4 meters; in the Lixia He area to the west of the Grand Canal, 5 to 7 meters and to the east of the Grand Canal 1 to 1.8 meters. From the ground level marshland fields where the terrain is relatively high, a harvest can usually be guaranteed despite drought or waterlogging; from the marshland fields surrounded by dikes on comparatively lowlying terrain, however, a

proneness to waterlogging exists. In the area east of the Grand Canal are some artificially built up marshland fields made by digging up soil and piling it.

5. Alluvial plain along the river. This includes the sediment deposited along the river and the shoals in the middle of the river, which have been formed in recent times by silt from the Chang Jiang riverbed. The land surface is ridge shaped and gently undulating, the protruding portions being sandy soil and the lowlying portions being loam. These lands have generally not attained the maximum height of mature alluvial deposits (i.e. the maximum flood level altitude). Current altitude is the altitude of reclaimed tidelands following emergence from the river of the shoals, which is equivalent to the average tide level and tidewaters can be used for automatic irrigation. Because tides run counter to the outward flow of water along the river, river ports are prone to frequent silting.

6. Coastal Plain. This is located south of the North Jiangsu Canal and to the east of the Chuanchang He, along the seacoast to the north of the North Jiangsu Canal, and in the east coast area of Xiangshui, Guanyun, and Lianyungang. Absolute surface altitude is 1.5 to 5 meters. The southern part of the area south of the North Jiangsu Canal is relatively high, the northern part of it sloping gently toward the shores of the Sheyang He. This is a sedimentary plain newly formed along the seacoast during the past 1,000 plus years, and the soil contains varying degrees of saltiness.

7. The Huang He alluvial flood plain. This runs along both sides of the old bed of the Huang He. Rising in the west in Feng and Pei counties, it passes through Suqian and Siyang counties in its middle, and travels eastward to Lianshui County and the seacoast in a huge arc. The land surface goes from an absolute height of 45 meters in the northwest in a gradual slope to below 3 meters in the east. The riverbed is about 10 meters higher than the lowlying land on both sides. The entire Huang He flood plain may be divided into the two broad types of high plain and lowlying plain. The terrain of the former is relatively high and drainage conditions are rather good, though the area is prone to drought. The terrain of the latter slopes only gently and drainage poses problems. The area is prone to waterlogging. The composition of the soil near the old riverbed is largely sand, which becomes gradually finer on both sides of the riverbed. Variegated alkaline soil [5363 4354 0960] is distributed mostly in the mid-section of slopes and around the edges of lowlying land.

8. Marshland Plain. By this is meant the marshy lowlying land that runs east and west between the Huang He flood plain and the hills and downlands of Ganyu County, which is locally termed "marshland." Soil composition is river and lake silt, the fertility of which is fairly high. The micro-relief is high around the sides and low in the middle, making it prone to accumulation of water and waterlogging. After changing from drylands to wetlands, the situation has greatly changed.

(2) Downlands

Downlands are a rolling terrain type with relatively flat crests. As a result of long use, an overwhelming majority of downlands now look like cultivated fields that are a combination of hillocks, flatland, and piles of dirt. The land surface has an absolute altitude of from 10 to 60 meters and a relative height that varies from a few meters to more than 10 meters. On the basis of composition of material, downlands may be divided into rocky downlands and loess downlands. Rocky downlands are located in the area of the East China sea and the southern part of the Ganyu County hill region. They consist of a rock stratum of metamorphic rock that has been eroded over a long period of time. Absolute altitude is from 15 to 50 meters, and relative altitude runs from 5 to 10 meters. Tops of downlands are flat. The porous covering layer is very infertile, consisting principally of mountain pebbles and hill sand. In valley areas among the mounds are deposits left by flooding in recent times and accumulated alluvium, the soil layer being comparatively thick. This is the major cultivated land in hilly regions. Loess downlands are distributed mostly in the Zhenyang hill region and in the Huaibei and Sihong areas. They are composed of subordinate loess in thick accumulations, generally to a depth of more than 10 meters. As a result of having been eroded by water steadily running over the surface for a long period of time, the original flat and intact surface has become a lacework of interconnecting gullies ranging from 10 to 100 meters in width. The gradient of valley slopes is generally 5 to 8 degrees, the maximum being 15 degrees. On the basis of elevation, the relative altitude of hillocks, ridges, and flatland, a ratio of hillocks to flatland and extent to which the area is eroded, downlands may be divided into three categories of high downlands, flat downlands, and gentle downlands.

1. High downlands. These are usually located in the upper reaches of river valleys and are not distributed over a wide area. Valley depths are rather great, the slope of hillocks rather steep, and undulation pronounced. Absolute altitude is from 40 to 60 meters; relative altitude is from 20 to 30 meters, the terrain being one of low hills. Slope gradients are mostly from 6 to 9 degress, and the terrain is quite severely eroded by running water. The terrain is divided into distinct areas of mounds, ridges, and flatlands, each of them occupying about one-third of the area. The tops of mounds and the layer of soil on high ridges is fairly infertile. Mountain water storage conditions are poor; the elevation to which water must be lifted is too high, and the land is suited to forests. However, most of it is now used for dryland agriculture, and erosion is rather severe. Alluvial valleys are rather deep and ravines are generally well developed. Conditions for collecting water are good, and the ravines that collect water from over a wide area make for good water impoundment.

2. Flat downlands. These cover the largest area and are widely distributed in places where low mountains and hills meet the plain. The surface of the land is cut up into rather small bits, gullies and ravines being rather well developed. Altitudes are relatively low, absolute altitude being from 20 to 40 meters, and relative altitudes being 10 to 20 meters. Most of the land forms long strips. Tops of mounds are broad and flat and slopes are gentle,

usually at a gradient of 2 or 3 degrees. Slopes are long and the alluvial valleys slope gently. The proportions of mounds, ridges, and flatlands is about 4:3:3. The undulation between hillocks and flatlands is less with high hillocks, and the erosion of the land is comparatively less. Because of the development of gullies, many of which are distributed like the palm of a hand with extended fingers, where branches and ravines meet with river valleys, conditions for storing water are rather good. However, in the flat downlands of Sihong in the north, water storage conditions are generally fairly poor and are augmented by drawing water for irrigation from rivers and lakes. Flatlands and ridges are now mostly wetlands. Tops of hillocks having conditions for irrigation have been opened for farming, some of them as drylands.

3. Gentle downlands. Most of these are located in gently sloping areas in the lower reaches of river valleys, their distribution being rather widespread. Elevations are low and slopes gentle. Absolute altitude runs from 15 to 30 meters; relative altitudes are 5 to 15 meters. Undulation of hillocks and flatlands is gentle, and gradients are from 1 to 2 degrees. Ravines cut down to about 10 or 15 meters, and are wide. The proportion of hillocks, ridges, and flatlands is 3:4:3. Conditions for collection and storage of water are poor; however, since these downlands are near rivers, conditions for the diversion of water are rather good, and elevations to which water needs be raised are rather low. Gently sloping hillocks are suited for development of flat fields with embankments around them with some raising of water for irrigation and most are wetlands.

(3) Low Mountains and Hills

Jiangsu Province does not have an extensive system of low mountains and hills, and those it does have are infertile and low in height, most of them being about 100 to 300 meters high. The terrain is cut up into pieces and hill slopes are fairly steep, most of them having gradients of 20 to 35 degrees. All are in the category of low mountains and insignificant hills. Mountains and hills constitute the main forestry production bases in the province, and the valleys between mountains have been opened to cultivation.

1. The low mountains and hills of the southwest. Distribution is most concentrated and includes the low mountains and hills of Ningzhen, Maoshan, Yili, and Xuchi. In Ningzhen and Maoshan, they are composed largely of Paleozoic limestone, shales, sandy shales, and Mesozoic intrusive rocks. Except for individual mountain peaks, most are low hills less than 300 meters high. Because of powerful erosion and cutting up over a long period of time, secondary river valleys have developed widely. Where mountains and hills intersect, other good catchment conditions exist for the storage of water, benefitting the valleys with free flowing irrigation. In the mountains of Ningzhen and Maoshan is the valley of the Qinhuai He, the largest in the province. Elevations in the Yili Mountain region are fairly great, being generally from 300 to 500 meters, the highest peak being 611 meters. Composition is mostly granite. As a result of powerful uplifting, fault structure and magmatic activity, and accompanying powerful erosion and cutting up, valleys have been cut deeply to as much as 200 to 300 meters, and the mountain systems have been broken up to form a combination of mountain basins and

chopped up mountains. Basins are distributed in a jumble throughout the mountains. Water resources are copious, and Quaternary Period accumulations are rather thick. The Xuchi hills in northern Jiangsu are largely low basalt hills ranging from 100 to 200 meters in height. The terrain slopes gently; weathering has been rather deep; and the soil layer is fairly thick.

2. The northeastern hill and mountain region. This is a southern extension of the mountain lands of southern Shandong Province, comprised mostly of Wushan, Jiashan, Kangrishan, and Yuntaishan and Jinbingshan along the sea in the east. Except for the purplish red sandy shale low hills of Malingshan in the south, the mountain rock strata are formed from Archaen Group ancient crystallized metamorphic rocks (principally gneiss). The mountains differ rather greatly in height. The purplish red sandy shale low hills are from 70 to 100 meters high and gently sloping. Most of the ancient metamorphic rock mountains are from 200 to 300 meters in height. Yuntaishan and Jinbingshan belong to the chopped up uplifted mountain systems with fairly high elevations, the highest peak being 625 meters high. As a result of uplifting and accompanying erosion and abrasion over a long period of time, the topography of the entire northeastern low mountain and hill area has been broken up. The rocks have been fairly heavily weathered; fairly thick drift have frequently formed on the slopes and escarpments.

3. The northwestern hills. In the area of Xuzhou, Tongshan and on to Pi and Suining counties are distributed remnant groups of hills formed largely of Cambrian and Orodivician limestone. They dot the Huai Plain, most of them with an altitude of more than 100 meters. As a result of longterm erosion, they are a classic example of remnant hills that look like islands. The rock strata are solid, and the weathered strata are very infertile. Since the hills are strewn across the landscape, and since limestone readily leaks water, conditions for storage of water in the system of hills is very poor.

In addition, low mountains and hills, most of which have an elevation of from 100 to 200 meters but a few of which are 300 meters and largely composed of quartzite, rim Lake Tai. Slopes are steep, but some valleys are broad. Drift on escarpments and alluvium are rather thick.

Section 2. Agricultural Climate

1. Basic Characteristics of Agricultural Climate

Monsoon circulation is the dominant factor controlling the province's climate. Since the province is situated along the East China Sea, its terrain flat, and neighbors the North China Plain to the north, winter and summer monsoons pervade the entire area unimpeded. Summers are fairly hot with much rainfall, making for good growth of all kinds of farm crops and forests, particularly for the growth of such moisture-loving, heat-loving crops as mulberry trees, temperate zone fruit trees, and some semi-tropical economic forest trees. Winters are fairly cold with little rain. Cold currents frequently move in, and are definitely disadvantageous to agricultural production. Differences in climate from year to year are rather great. As a result of differences in intensity of monsoons from one year to another, differences in the time

monsoons begin and stop, and differences in their duration, which causes changes in amount of precipitation and temperatures, in some years varying degrees of danger from drought or waterlogging, and fluctuations in the farming season exist.

Jiangsu Province is located in the mid-latitudes between north and south, which means it is characterized by a transitional climate. The province is located between 30° 35' and 35° 07' north latitude. The dividing line for climate in China--the Qinling Mountains, the Huai River, and the North Jiangsu Canal cut across the northern part of the province, and in terms of the hot belt of the country, it is a transitional area between the semi-tropical and temperate zones. The transitional nature of the climate is reflected largely in the varied climate and regional differences. Farm crops, various kinds of forest trees as well as livestock and aquatic products may generally be grown either north or south, and this is very advantageous for the introduction and domestication of animals, and particularly for plants, to the north or south. Full and effective use of heat resources in agricultural production permits development of a multiple crop system, but the scheduling of seasons is critical. Making sure crops are planted in the right season and struggles with the weather are major characteristics of agricultural production in the province. The regionality of climate north and south is rather striking. The area north of the Huai is part of the temperate semi-humid region where the annual amount of rainfall is relatively small and largely concentrated in the summer season, the winters being cold and the summers being hot. The area south of the Huai is part of the semi-tropical humid region where annual amount of rainfall is relatively great, where one season is pretty much like another and winters mild. Length of growing seasons, total amount of heat, and moisture conditions differ sharply between north and south. This affects the farming system, kinds of crops, farming methods, agricultural measures, and water conservancy facilities. As a result, adaptation of general methods to local situations in the planning and conduct of agricultural production is extremely important.

The agricultural climate of the province is characterized as both continental and marine. The continental climate is manifested by cold winters and hot summers, fairly great temperature differences in the course of each year, concentration of rainfall in the summer season, and fairly great changes in the amount of rainfall. However, as a result of the direct influence of the ocean, coastal areas have a definite marine climate, temperatures during spring and summer being fairly low, and conditions being fairly dry at the onset of winter. This results in a fairly short growing season, comparatively little total amount of heat, and a tendency toward delay in the season for sowing of fall ripening crops, and in the growth and development of summer and fall ripening crops. Therefore, attention must be given this point when introducing varieties or in promoting the experiences of other places with farming techniques.

2. Heat Resources and Sunshine Conditions

Jiangsu Province has fairly abundant heat resources. The general tendency in heat distribution is more in the south than in the north, and more inland than in coastal areas. Annual atmospheric temperatures throughout the

province average 13 - 16°C. South of the Chang Jiang, temperatures average 15 - 16°C; between the Chang Jiang and the Huai, they average 14 - 15°C; and north of the Huai and along the seacoast, they average 13 - 14°C. During the coldest month of winter (January), temperatures average 3 - -3°C. Differences between south and north are fairly striking, a difference of one degree of temperature for each degree of latitude, with the difference being somewhat greater along the seacoast than inland. The hottest month of summer (July) sees average temperatures of 26 - 29°C with some differences from place to place, temperatures being higher in the south than in the north, and higher in the west than in the east. The average frost-free period for the province annually is between 200 and 240 days, the trend likewise being fewer frost free days as one goes from south to north. South of the Chang Jiang, frost free days number 220 to 240; between the Chang Jiang and the Huai it is between 210 and 220; and north of the Huai, it is 200 to 210. The number of days for which daily temperatures consistently average 3°C to 10°C reflect the annual growth period for crops and the growth period for crops that like warm temperatures, the two being 267 - 304 days and 210 - 230 days respectively. Their distribution follows the same tendency as for the other heat indicators discussed above.

Map Showing Annual Average Atmospheric Temperature Distribution for Jiangsu

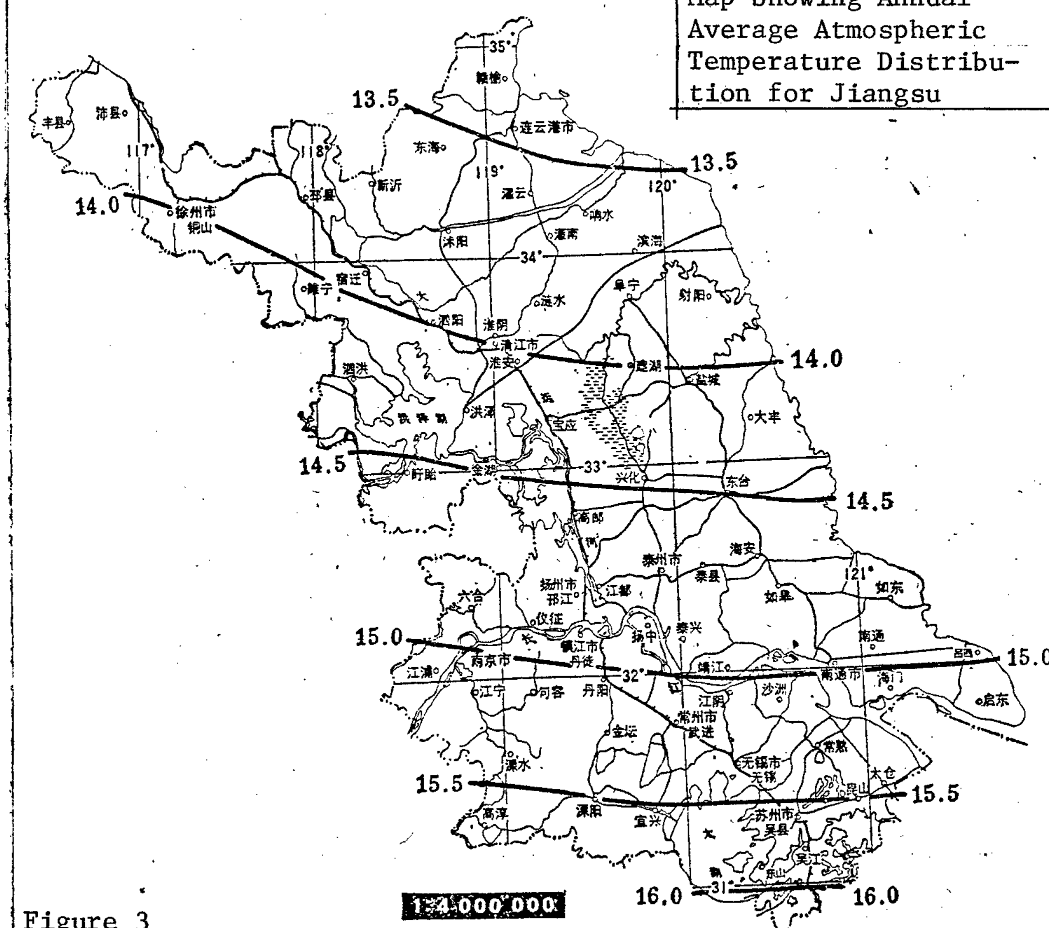

Figure 3

(1) Several Major Crops and Heat Conditions

1. Wheat, Barley, and Naked Barley. In the fall when average daily temperatures stabilize at 3°C for the entire day, wheat, barley, and naked barley enter the overwintering stage in Jiangsu Province. In springtime when average daily temperatures begin to stabilize at 3°C, wheat, barley, and naked barley began to turn green. The average beginning of the overwintering period for wheat, barley, and naked barley north of the Huai is between 29 November and 5 December; between the Chang Jiang and the Huai between 6 and 15 December; and south of the Chang Jiang between 13 and 21 December, a difference of about half a month from north to south. Before the overwintering period for wheat, barley, and naked barley begins, a certain period of growth for young shoots and accumulated heat is necessary. In order to assure strong seedlings before the onset of winter so that the grain crops can effectively resist cold damage and safely overwinter and later grow into healthy, early ripening crops with enhanced resistance to disease, moisture, and dry winds, it is necessary to make sure that wheat, barley, and naked barley are planted on time so that a foundation is laid for a bumper harvest. The start of planting of wheat, barley, and naked barley in Jiangsu Province varies by as much as from two to three solar terms [each solar term being about 15 days] from north to south. In the area of the Xu and the Huai, planting time is between the autumn equinox and cold dew [around 8 October]; south of the Chang Jiang, it is between hoar frost descends [around 23 October] and winter begins [around 7 November], the exact time being controlled by the earliness or lateness of the early period of overwintering. The right time for sowing wheat, barley, and naked barley in various parts of Jiangsu is between late September and early October north of the Huai, between early October and mid-October between the Chang Jiang and the Huai, and between mid-October and late November south of the Chang Jiang. Early planting should usually be done within these periods. However, the time when wheat, barley, and naked barley is sown is restricted by the time of clearing away of the previous crop. In some places, numerous late crops are sown, and following development of a triple cropping system with two crops of rice, an expansion occurred in late crops of wheat, barley, or rice. Furthermore, during the past few years the number of varieties of wheat, barley, and naked barley in Jiangsu Province have increased, and the proper time for sowing winter, semi-winter, and spring varieties has generally lengthened. However on the basis of experiences during the past several years, and after combining regular patterns for normal years, wheat, barley, and naked barley should be planted no later than the end of October north of the Huai He, no later than 10 November in the area between the Chang Jiang and the Huai, and no later than 20 November in the area south of the Chang Jiang. In order to assure on-time sowing of wheat, barley, or naked barley, most important is to give consideration to the place in the crop pattern that these grains occupy, making arrangements with all factors in mind. The crop planted just before wheat, barley, or naked barley should be an early maturing variety so that it can make way for the succeeding crop. Even in the case of the late crop one should strive for early planting, or early sprouting of late plantings, or early growth of late sprouts for high yields from wheat, barley, and naked barley. The overwintering period for wheat, barley, and naked barley is between 85 and 95 days north of the Huai, between 65 and 85 days between the Huai and the Chang Jiang, and between 50 and 65 days south of the Chang Jiang, a difference of between 30 and 35 days between north and south.

Intensification of care of wheat, barley, and naked barley during the overwintering period has a lot of bearing on insuring the safe overwintering of these crops, on getting tillering before the onset of winter, and in promoting large and numerous spikes during the late season. During the overwintering period south of the Huai He, in particular, where temperatures tend to fluctuate, with occurrances of warm periods in which temperatures rise to above 3°C, leaf aging and tillering can continue, so close attention to crop care during winter is necessary. The onset of greening of wheat, barley and naked barley occurs in early March north of the Huai and along the seacoast, in late February between the Huai and the Chang Jiang, and between 20 and 25 February south of the Chang Jiang, a half a month difference among the various places. These greening dates make for timely growth and development. The ripening period for barley and naked barley is usually between mid and late May, and in early June for wheat, the dates differing from south to north. In coastal areas, ripening is slighting later than inland.

2. Paddy rice. When there is an 80 percent chance that average daily temperatures will stabilize at 12°C on a particular day, this is the safe period for sowing rice. Throughout the province, the sowing season for paddy rice is pretty much the middle of April. Actual sowing times are between 10 and 12 April south of the Chang Jiang, on 15 or 16 April between the Chang Jiang and the Huai He, and between 18 and 20 April north of the Huai. In order to do early sowing and early transplanting so as to arrange planting of the succeeding crop on a tight schedule, cold tolerant varieties are sown to get in "at the tail of the cold season and at the head of the warm," care in seedling propagation is intensified, and the sowing time suitably advanced. Particularly when various methods are used to preserve warmth in the propagation of seedlings, methods such as propagation using plastic sheeting, the propagation of early crop rice seedlings may be advanced by about 10 days over the afforestated early periods. During the planting season for early rice low temperature weather may frequently occur. South of the Chang Jiang, in particular, springtime is cold with much rain; low temperatures and overcast, rainy weather often occur at the same time. This is disadvantageous for propagation of early crop seedlings, and care must be intensified to prevent seedlings from rotting or dying. In order for paddy rice to have a safe heading period, and particularly to enable late rice as the second of two rice crops to produce consistent yields, agricultural temperature criteria are crucial. Generally speaking, when cold tolerant varieties are planted, when it is 80 percent certain that average daily temperatures will stay above 20°C and that there will be no 3 or 4 day periods when temperatures are lower than 20°C, this is an indicator that the rice may head safely. Such a time is between 20 and 22 September south of the Chang Jiang, between 18 and 22 September between the Chang Jiang and the Huai (and slightly later in coastal areas), and between 13 and 17 September north of the Huai. However, inasmuch as cold tolerance of varieties differs, there are also slight differences in their safe heading periods. All locales should use temperature data from previous years, relying particularly on actual temperature conditions in any given year to make sensible plans for crop patterns for different varieties.

3. Cotton. On the first day on which there is an 80 percent chance that soil temperature 5 centimeters beneath the surface will be 13°C with a corresponding

atmospheric temperature of 12°C, this is the safe period for sowing cotton. North of the Huai (in the central and western region), this is around 20 April. Along the Chang Jiang (on both banks of the river from Dongtai south), it is between 14 and 17 April. Along the seacoast (the coastal cotton growing area to the north of Dongtai), it is between 20 and 25 April. Cotton is a thermophilic crop. Suitably early planting can increase the period of growth, which helps increase output and improve quality. However, in Jiangsu Province, temperature variations during April are rather large, and frequently it is not easy to be sure of the proper time for planting. In order to achieve the goal of a full stand from early sowing, it is necessary to think about the time when spring temperatures begin to rise in any given year, and how rapidly they climb in order to make sure. For example, if it is a year in which spring temperatures begin to rise early north of the Huai, but a year in which the speed of climb in spring temperatures is rather slow, figuring half a month between the time of sowing and sprouting, sowing should be done 10 days after temperatures have reached 12°C. In years in which temperatures begin to climb late, but in which the speed of climb is fast, as soon as temperatures reach 12°C, rush planting should be done at once. In ordinary years, once temperatures reach 12°C, depending on the weather, sowing should be done to catch "the tail end of the cold and the head of the warm." In areas along Chang Jiang, in Most years a period of warm weather occurs between 16 and 25 April. Though this is a period when cold alternates with warm and fairly heavy spring rain falls, in most years the warm spell lasts for several days, so around the time of grain rains [around 20 April] is the right season for planting. Setting the cotton planting season also requires full thought to realities such as rotational cropping and soil quality in individual areas. For example, because of the habit of intercropping with cotton along the Chang Jiang, and because of the effect of saline soil in coastal cotton growing areas, regular sowing seasons cannot be too early. Therefore, the sowing season for cotton in the province is generally just before or just after the grain rains, carying from 15 April north of the Huai to 20 April along the Chang Jiang, to 25 April in seacoastal areas. The safe ripening time for cotton is generally the period of "killing frost" (the first day on which the lowest temperature is $\leq$ 0°C) in any given area. North of the Huai this is usually in mid-November, or in late October at the earliest. Along the Chang Jiang it is in mid-November, the earliest being early November. In seacoastal areas, it is in late November, the earliest being in early November. For a safe growing season for cotton, the province's average 217 to 240 days satisfies to the fullest the needs of cotton growth.

Map Showing Distribution of Sustained Average Daily Accumulated Temperature of $\geq$ 3°C in Jiangsu Province

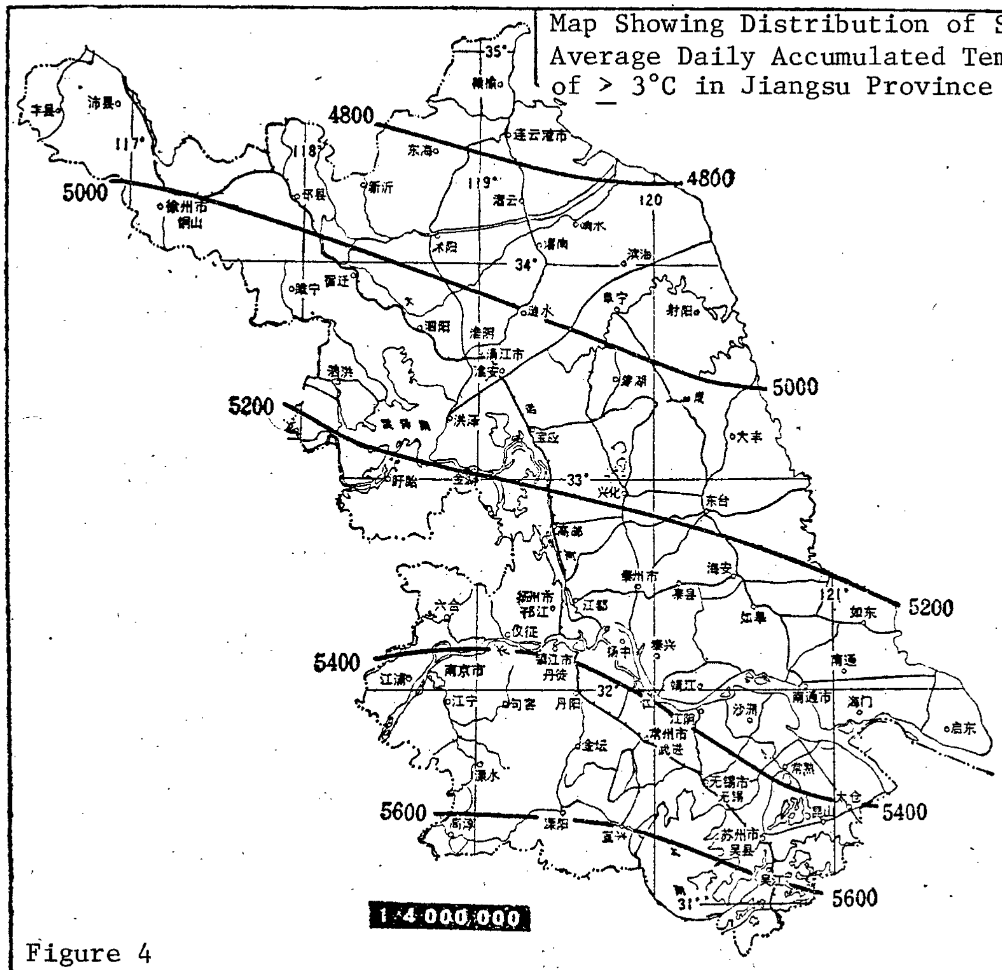

Figure 4

Map Showing Distribution of Sustained Average Daily Accumulated Temperature of $\geq$ 10°C in Jiangsu

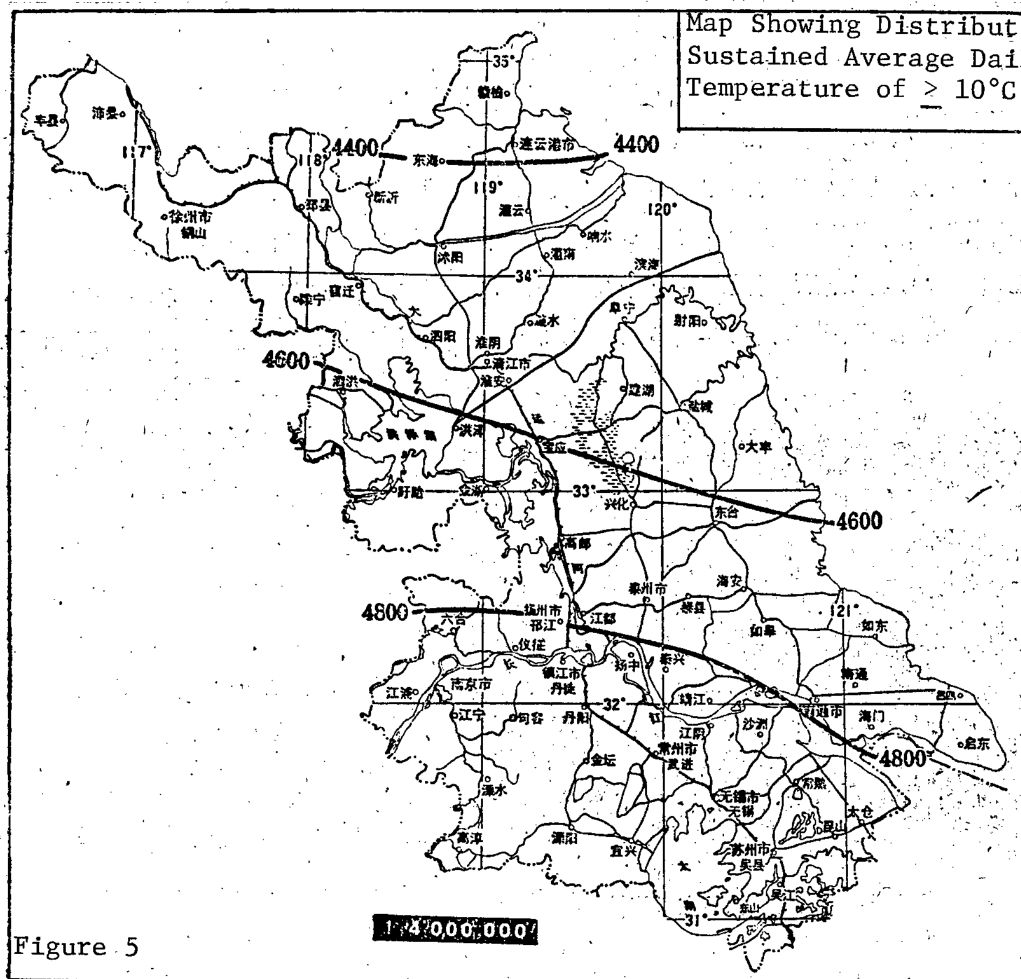

Figure 5

(2) Total Heat Conditions and Crop Patterns

Full Use of heat resources means full use of 3°C accumulated temperature (i.e. total heat during the growing season during the entire year) as well as full use of 10°C accumulated temperature (i.e. the total quantity of heat for thermophilic plants), adapting general methods to local situations to make sensible arrangements for a combination of various crops. Sustained average daily accumulated temperatures of 3°C and 10°C throughout the province means accumulated temperatures of from 4,700 to 5,000°C and 4,300 to 4,960°C respectively, the corresponding number of sustained days being from 267 to 304 and from 210 to 230 respectively. This shows that a diversified triple cropping system is practical in the region south of the Huai in Jiangsu Province, but the timing of the seasons is tight, and sensible crop patterns for crop varieties and suitable techniques are necessary to make use of every means possible to rush the seasons. To conduct a diversified double cropping system in areas north of the Huai, the total amount of heat is plentiful, and furthermore to conduct a triple cropping system (such as wheat, barley, or naked barley - corn - sweet potatoes) through intercropping, is also possible.

(3) Overwintering Conditions for Semi-tropical Trees, Fruits, and Tea

Apart from the special conditions they individually require, a common problem that sets the northern limits for the growing of moso bamboo, China fir, tung oil trees, citrus trees, and such semi-tropical economic forests and fruits as well as tea plants is overwintering conditions. From Yangzhou on the Grand Canal directly southward to the Tai Lake region and the Yili mountain area, the annual absolute minimum temperature for many years has averaged -8 to -10°C, making this area suitable for the growing of moso bamboo, China fir, and tea. The Gucheng Lake basin in Gaochun County, the Yili Mountain region, the hills around the shores of Tai Lake, and the islets in the lake have for many years had an absolute minimum temperature higher than -8°C, making these places suitable for the growing of citrus, loquats, red bayberries, tung oil trees and such diverse semi-tropical trees as well as tea. North of Yangzhou on the Grand Canal, for many years the absolute minimum temperature has averaged -8 to -12°C, and in some areas (such as the Weichi hills) moso bamboo, China fir, and tea may be grown. In the area north of the Huai He, for many years absolute minimum temperature has averaged below -13 to -14°C with extreme lows of from -19 to -24°C, which is lower than the borderline temperature at which various semi-tropical trees sustain severe freeze damage or die. It is generally not suited for such plantings; however, in favorable terrain under suitable microclimatic conditions (such as in the hilly regions of the northeast), through use of appropriate protective and other farming measures, some tea, moso bamboo, and China fir may be developed.

(4) Sunshine

The farther north one goes in the province, the greater the amount of sunshine. A comparison of average daily sunshine annually shows the area north of the Huai to have between 2,300 and 2,600 hours, and the area south of the Huai with between 2,000 and 2,300 hours. In most places the month with the greatest number of hours of sunshine in August (between 250 and 270 hours). The average number of hours of sunshine per month is greater than 200, and 60 percent of the months have a 100 percent sunshine rate.* North of the Huai there are 8 such months (March to October); in the area between Chang Jiang and the Huai there are 3 such months (June to August); and south of the Chang Jiang there are between 1 and 2 such months (July and August).

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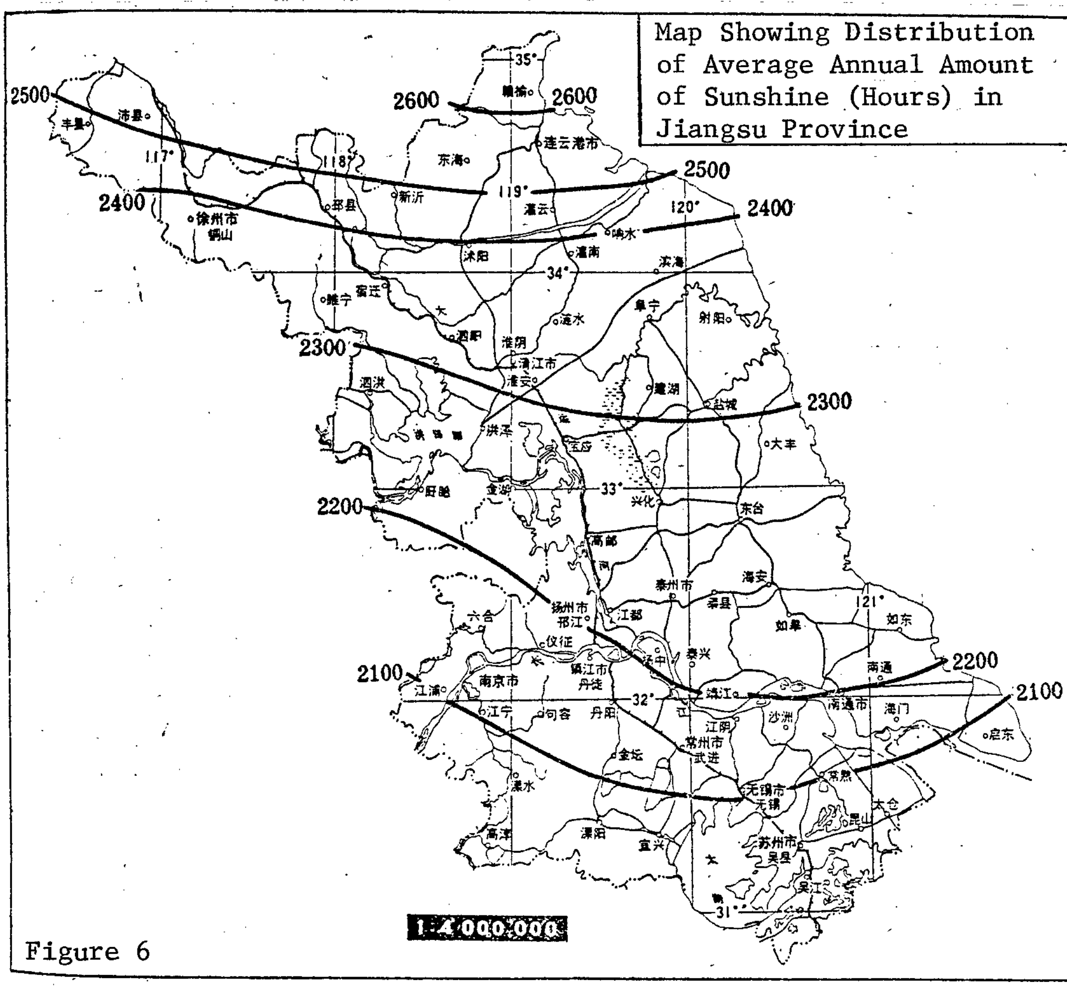
*By "100 percent sunshine rate" is meant the actual number of hours of sunshine as a percentage of the possible number of hours of sunshine. By the "possible number of hours of sunshine" is meant the period of time between astronomical sunrise and sunset.



Map Showing Distribution of Average Annual Amount of Sunshine (Hours) in Jiangsu Province

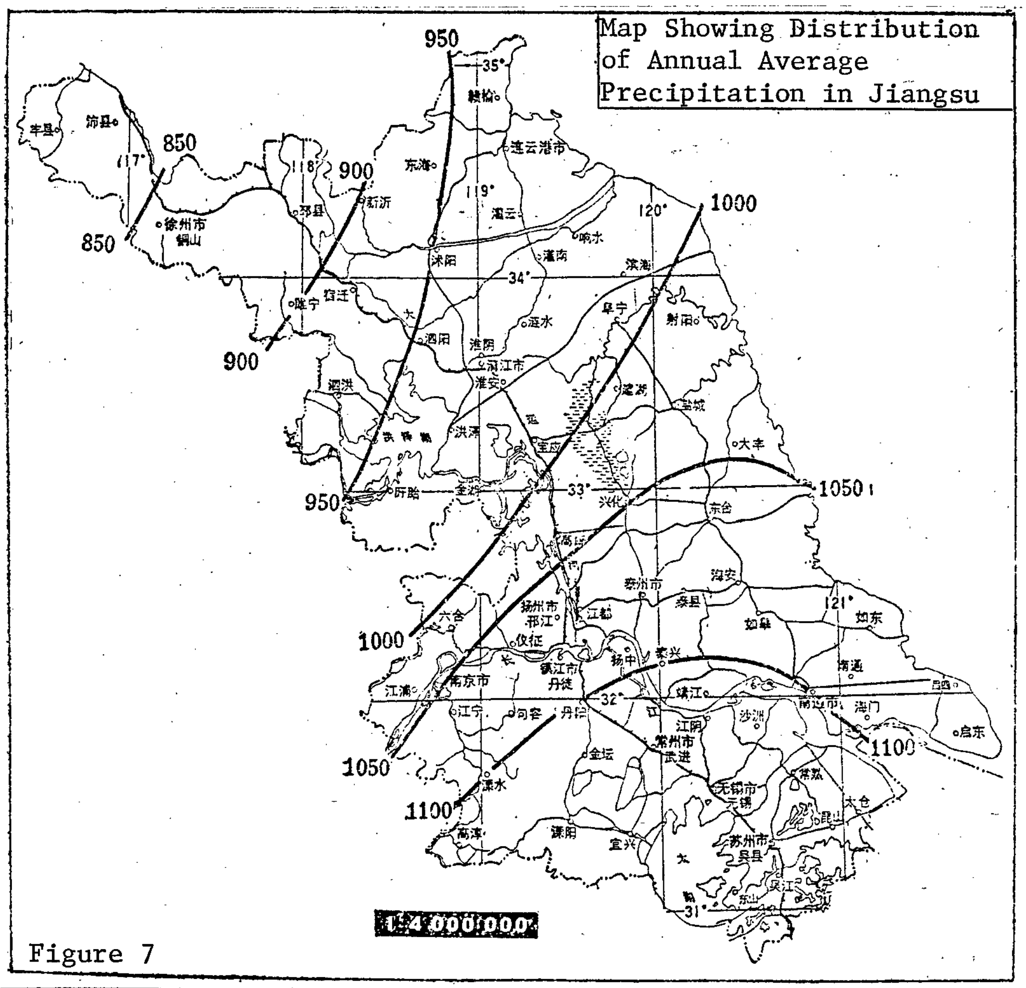
Figure 6

3. Moisture Conditions

(1) Relationship Between Characteristics of Precipitation and Farm Crop Growth

The average total annual amount of rainfall in Jiangsu Province has been between 850 and 1,200 millimeters for many years, more of it in the south than in the north, more along the seacoast than inland, and the amount gradually decreasing from the southeast to the northwest. Precipitation is greatest south of Lake Tai, in the Yili Mountains, and near the mouth of the Chang Jiang, amounting to more than 1,150 millimeters. In the area between the Huai and the Chang Jiang, between 950 and 1,100 millimeters falls. North of the Huai, between 850 and 950 millimeters fall. In terms of total quantity, the precipitation situation everywhere is rather good in assuring crop moisture needs. Seasonal distribution of precipitation is as follows: Concentrated mostly in the summer season (June to August), when between 40 and 60 percent of the total falls, and the farther north the greater the concentration in summer (40 percent in the south; 60 percent in the north). In autumn (September to November), between 20 and 25 percent of the total falls, with not much variation anywhere in the province. In spring (March to May),

between 15 and 25 percent falls. During winter (December to February), very little falls, the amount being only between 5 and 15 percent, the farther north the less. Rainfall during the crop growing season of from April to October amounts to as much as between 75 and 85 percent everywhere. This is a principal characteristic of precipitation in the province, and one that benefits agricultural production. However, inasmuch as kinds of crops differ from place to place, and inasmuch as the needs of different crops for moisture vary at different stages of their growth and development, the favorable or unfavorable effects of seasonal distribution of precipitation varies in different places and in different seasons.



Map Showing Distribution of Annual Average Precipitation in Jiangsu

Figure 7

In springtime, along both shores of the Chang Jiang and south of the Chang Jiang precipitation during each of the three 10 day periods of March increases to between 20 and 30 millimeters. This is helpful to the greening up and jointing of wheat, barley and naked barley, and to the growth of rape. However, between March and May, when jointing of wheat, barley, and naked barley reaches the stage of maturity, rainy, overcast weather frequently appears.

In springtime average total amount of rainfall is between 200 and 250 millimeters in the area between the Chang Jiang and the Huai, and between 250 and 310 millimeters south of the Chang Jiang. In the eastern part of the area south of the Chang Jiang, spring rainfall is greatest averaging between 24 and 42 days. This leads to proneness to wetness damage in wheat, barley, and naked barley, and has an unfavorable effect on the propagation of seedlings of early rice. Wetness damage is the greatest threat to the production of wheat, barley, and naked barley in the area south of the Huai. An analysis of records shows that whenever the amount of precipitation during the 3 months of March, April, and May is more than 400 millimeters, a great drop in output of wheat, barley, and naked barley occurs (as was the case in 1963, 1973, and 1977). In addition, wetness damage is also the major factor in outbreaks of such wheat, barley, and naked barley diseases as scab and powdery mildew. Therefore, prevention of wetness damage is a key measure for winning consistently high yields of wheat, barley, and naked barley. In the Huai He basin, particularly in the area north of the Huai, matters are just the reverse at this time. In springtime, little rain falls during any 10 day period, and by the middle or last 10 days of April, average precipitation is only 20 to 30 millimeters for each 10 day period. Spring dryness hurts spring sowing, particularly by causing a shortage of water for the transplanting of seedlings. It also hurts wheat, barley, and naked barley, which need water for jointing and spiking, and it hurts the sprouting of cotton plants. Furthermore, from the last 10 days of April until mid-May, in the area between the Chang Jiang and the Huai and in all places south of the Chang Jiang, when wheat, barley, and naked barley are flowering and coming into milk, temperatures of more than 15°C, much rain, and high humidity (relative humidity of more than 90 percent) may occur, making the crops prone to scab.

During summer, between the first 10 days of June and the middle 10 days of July south of the Chang Jiang, and between the middle 10 days of June and the middle 10 days of July in the area between the Chang Jiang and the Huai, the season of the plum rains begins. This is the major single annual rainy season in both areas. During the three consecutive 10 day periods of maximum precipitation in all places, more than 200 millimeters falls over a period of about half a month. In most years, moisture requirements in the broad rice growing region south of the Huai are fairly well assured. However, because of variations in the intensity of cold and warm air each year, a very great difference exists in the plum rains from one year to another. In years of the "early plum", summer drought may come early or rainfall may be excessive. In years of the "empty plum," long dryness without rain ensues. In some years, during the period of the plum rains continuously overcast and rainy days with low temperatures may occur, or else during the end of the period of the plum rains, continuous heavy or torrential rains may take place. All these things hurt agricultural production. After mid-July, all of the area south of the Huai is under the control of a secondary tropical high pressure. Rainfall declines precipitously, and swelteringly hot dry weather may appear. In the area north of the Huai, on the other hand, the period from late June until August is the rainy season when temperatures are high and rainfall copious. Conditions are good for assuring moisture to crops that ripen in the fall; however, in some years, summer waterlogging poses a threat, but in mid to late August, the amount of rainfall noticeably declines.

Following the arrival of autumn, cold air currents from the north gradually intensify and the whole province is under the control of a cold high pressure. The autumn sky is clear and the air is crisp. Most days are bright and sunshine is copious, which is very beneficial for the autumn ripening crops. But the probability of an autumn drought is fairly great, and this sometimes hurts the fall sowing of crops. In a small number of years, the autumn rains go on and on, which is bad for the ripening of the cotton, or else they make it necessary to plow and plant autumn crops in mud. In coastal areas violent typhoons and torrential rains occur in some years to the detriment of agricultural production.

(2) Precipitation Rate of Change and Rate of Assurance

In Jiangsu Province, the annual relative rate of change* in precipitation gradually increases from south to north and from the seacoast to the interior. In the area around Tai Lake it is about 15 percent, and to the northwest of the Xu and the Huai it is nearly 30 percent. During all 10 day periods in spring, the rate of change north of the Huai is greatest, and south of the Chang Jiang least. In all 10 day periods of summer, the rate of change is greatest south of the Chang Jiang and in the area between the Huai and the Chang Jiang, and least north of the Huai. In all 10 day periods of autumn the rate of change is greatest north of the Huai and in the area between the Huai and the Chang Jiang.

In the area between the Chang Jiang and the Huai and in the area north of the Huai, annual changes in the amount of precipitation are greater than in areas south of the Chang Jiang. The maximum absolute rate of difference south of the Chang Jiang is plus or minus 500 millimeters, while in the area between the Chang Jiang and the Huai and north of the Huai it is plus or minus 600 millimeters. Years in which the difference in annual amount of precipitation was not over 300 millimeters totaled more than 80 percent south of the Chang Jiang, while in the area between the Chang Jiang and the Huai, and north of the Huai, they totaled less than 75 percent. This shows that dependability of precipitation in the area between the Chang Jiang and the Huai and north of the Huai is less than south of the Chang Jiang, i.e. the rate of assurance of precipitation south of the Chang Jiang is higher than in the area between the Chang Jiang and the Huai and north of the Huai.

4. Major Meteorological Disasters for Agriculture

(1) Drought

In Jiangsu Province, drought conditions in the Xu-Huai region are fairly serious. The hilly region of Zhenjiang and Yangzhou runs second. In the Tai Lake area they are lightest, and other areas are normal. Investigation and

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*"Absolute rate of change in precipitation" means the average difference between the amount of precipitation during a given period of time and the average amount of precipitation during the same period in an ordinary year. This average difference as a percentage of average amount of precipitation during the same perid for many years is the "relative rate of change in precipitation."

the analysis of meteorological data for the last 26 years shows that drought occurs in the Xu-Huai area mostly in spring and fall, and 3 years out of every 5. In most years the amount of precipitation falls short of crop requirements by more than 30 percent. For example, in the period between greening up and ripening of wheat, barley, and naked barley, precipitation is between 50 and 60 percent less than the amount needed. In severe years, frequently drought is continuous from fall to winter to spring, or the equivalent of a drought once every 1 to 2 years (1961-1962, 1964-1965, 1969-1970, 1971-1972). Sometimes drought occurs at the end of spring and the beginning of summer. It is particularly likely in early summer (early June), when it averages twice every 3 years. This has a fairly great impact on the area planted to rice in this region where water conservancy measures must be improved. In the Zhenjiang and Yangzhou hilly region, drought is most common in summer where it occurs on an average of 7 years out of 10. During July and August, in particular, the danger of drought is greatest. In a 26 year period, serious drought occurred three times (1966, 1968, and 1973), when most dams and catchments dried up. Though little rain falls in the Lake Tai area during mid-summer, irrigation conditions are good, and droughts rarely turn into disasters.

Dry winds are also a kind of drought. Mostly they occur during May and June at the end of spring or early summer and were most frequent during the end of May in 40 percent of years. Mostly they take place in the Xu-Huai area where they are more severe in the west than in the east. Coastal areas and the north come next, but they have little affect elsewhere. Dry winds are mostly seasonal arid winds of high temperature, low humidity and heavy evaporation that are accompanied by southwest winds of force three or above. The high heat forces wheat, barley or naked barley that is in the coming-into-milk or ripening stage to ripen, and the grain shrivels, seriously impairing output.

(2) Rain Waterlogging

Rain waterlogging is caused mainly by large torrential rains or multiple torrential rains brought by the plum rains south of the Huai or the monsoon rains north of the Huai, or by typhoons. South of the Huai, the plum rains enter the plum season in early June (as was the case in 1956) at the earliest, and continue on until the end of July (as was the case in 1954) at the latest. The plum rain season may last for as long as more than 40 days (as was the case in 1956) at the most. North of the Huai the monsoon rains usually begin on 26 June and end on 5 August, a period of 41 days. Most of the rainstorms are brief showers, fierce in their intensity, and coming on suddenly. According to analysis of data for the years 1959 to 1974 on torrential rains lasting for 12 hours and dropping more than 70 millimeters of rain in this province, they were characterized in the following ways: (1) They were concentrated largely in the period between late June and early September; occurred on an average of 13 times a year, and accounted for 76 percent of the year's total rainfall. They occurred most frequently during July on an average of six or seven times each year, and accounted for 36 percent of total rainfall for the year. (2) The average onset of such rains (the first large downpour) was earliest in the western part of the area south of the Chang Jiang, coming in mid-June. Between the Chang Jiang and the Huai and north of the Huai, they came between late June and early July. Along the Chang Jiang and south of it to the east, they came a little later in early or mid-July. Their earliest

occurrence was on 3 March (1966 in the western part of Huaiyin Prefecture and in Yancheng Prefecture). They ended on an average between 5 and 15 August in the western part of the area north of the Huai, in the northern part of the area between the Chang Jiang and the Huai, and in the eastern part of the area south of the Chang Jiang. In other places they ended in late August. The latest date on which they ended (along the Chang Jiang in 1965) was 7 November. (3) Regional Distribution: There is more north of the Chang Jiang than south of it, more along the Chang Jiang than inland; and the eastern part of the area north of the Huai received most in the province. Overall, many years data on rain waterlogging shows Yancheng Prefecture to be most hard hit, followed by Xuzhou and Huaiyin prefectures. Nantong Prefecture suffered most from typhoon torrential rains, most of which took place in summer and fall, sometimes serious rain waterlogging occuring. In the Lixia He area, where the land is lowlying, waterlogging frequently occurred in the past. In the hilly area around Zhenjiang and Yangzhou, where the terrain is rolling, flooding and waterlogging sometimes threatens as a result of heavy downpours. On the Lake Tai Plain, where drainage is very good, the effects of rain waterlogging are very slight.

(3) Typhoons

In the 23 years between 1953 and 1975, 75 typhoons struck Jiangsu Province causing varying degrees of damage to autumn ripening paddy rice, cotton, and corn crops. However, in drought years typhoon rains played a role in relieving the drought. Typhoons are concentrated in the period from July to September, when 84 percent of them occur. Most of them occur between early August and mid-September, a total of 56 percent of them. Areas in which typhoons cause disaster are more numerous in coastal areas than inland, and in the south rather than in the north. The number of typhoons causing disasters in coastal areas (See Figure 8, districts 3, 5, and 6) amounted to 63.2 percent of the total number. In the south (See districts 5 and 6), 45.7 percent of the total caused disasters. Along the eastern reaches of the Chang Jiang, and in Nantong and Suzhou prefectures (see district 6), typhoons are most numerous.

Table 1-1. Time Distribution of Typhoons Affecting Jiangsu Province

(1953~1975)

Intensity	Region \ Time	May Mid	May Late	June Early	June Mid	June Late	July Early	July Mid	July Late	August Early	August Mid	August Late	Sept. Early	Sept. Mid	Sept. Late	Oct Early	Oct Mid	Oct Late	Nov Early	Total
Some Effects	1			1	1		1	1	4	2	4	1	4	4	2			1	2	28
	2							1	2	4	2	3	1	3	1			1	1	19
	3				1			3	1	1	1	2	3	1	3				1	17
	4	1						4	3	3	2	1	2	3	1		2	1		23
	5	1		1	1			1	2	2	3		1	3			2	1		18
	6	1							1	2	1		2	1	1		1			10
Light Disaster	1							1	1	1	2	1	3		1					10
	2		1	1			1	2	2	3	2		4	1	2	1	1		1	22
	3			1			2	1	3	2	4	1	2	3		1	1	1	1	23
	4		1	1	1		1	3	2	1	2	2	2	4	1	1			1	23
	5		1	1			2	5	1	2	3	2	1	3	2		1		2	26
	6		1				2	6	2	2	3	2	1	4	2		2	1	1	29
Moderate Disaster	1							1		2	1		1							5
	2							1	1	1	1	1	2	1	1					9
	3		1				1	2	2	3			2	1	1					13
	4						1		1	2	3		4		1				1	13
	5								2	3	1	1	4	2	2	1				16
	6				1				4	3	2	2	4	4	1	1			1	23
Severe Disaster	1																			0
	2							1			2		1	1						5
	3							1		2	2	1	1	1						8
	4									2	1	1	2	1						7
	5							1		2	2		4							9
	6			1	1		1	1		2	3		3		1					13
Total Number of Typhoons		1	1	1	2		3	7	7	9	9	4	10	9	5	1	3	1	2	75

Explanation: 1. Typhoon Intensity Criteria:

(1) "Some Effects" -- Rainfall of from 0.1 - 49 millimeters or wind speeds of 8 - 9 meters per second.

(2) "Light Disaster" -- Rainfall of from 50 - 99 millimeters or wind speeds of 10 - 14 meters per second.

(3) "Moderate Disaster" -- Rainfall of from 100 - 200 millimeters or wind speeds of 15 - 17 meters per second.

(4) Severe Disaster -- Rainfall of more than 200 millimeters or wind speeds of more than 17 meters per second.

(2) For "Region," see the separate figure titled, "Jiangsu Regional Typhoon Map."

Jiangsu Regional Typhoon Map

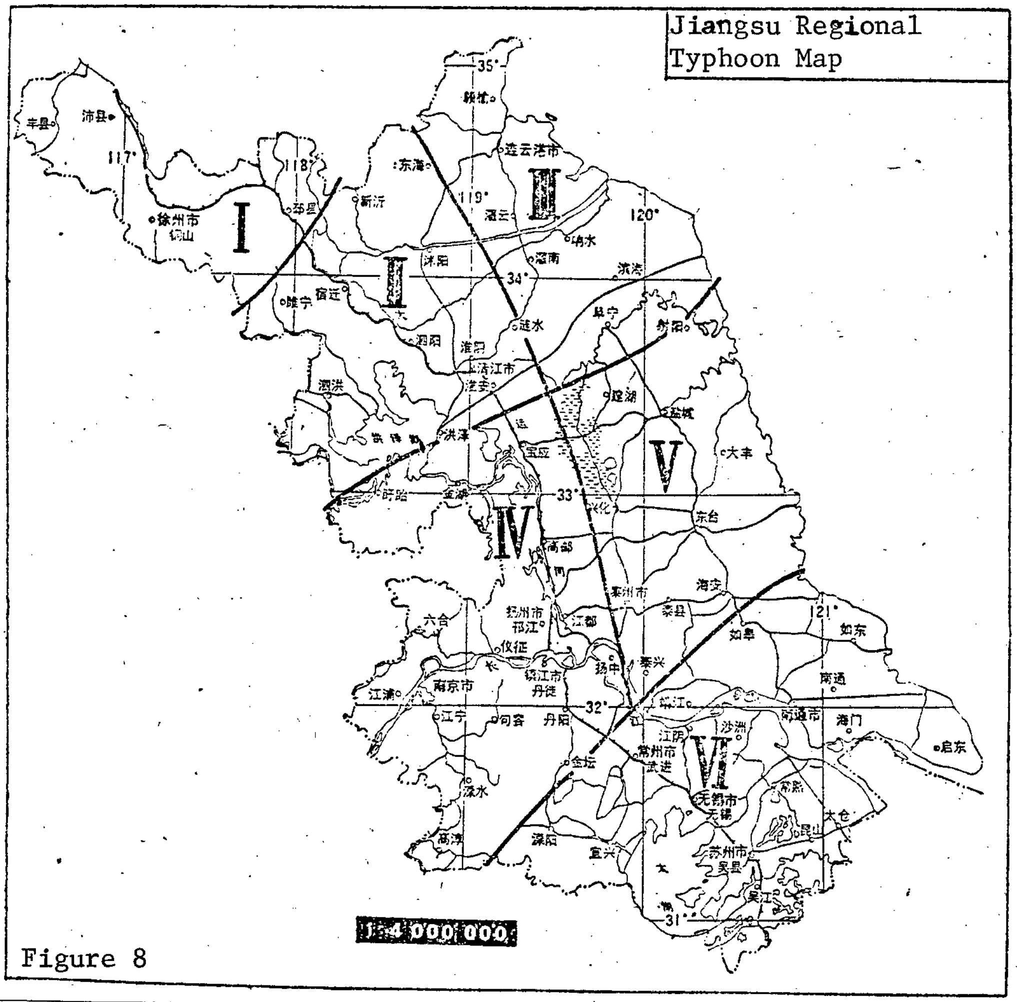


Figure 8

(4) Freezing Frost

By freezing frost is meant days on which lowest atmospheric temperature is $\leq 0°C$, when wheat, barley, or naked barley that has already jointed, rape that has already branched, or the young shoots of paddy rice and cotton will be killed in the spring. It will also freeze the stalks and leaves, or kill paddy rice, cotton, sugarbeets, and such autumn ripening crops in the fall. It will cause damage to some semi-tropical trees introduced into the north as well. North of the Huai He, spring frosts usually end around the end of March or in early April, 20 April at the very latest. In the area between the Chang Jiang and the Huai, they end in late March, 11 April at the very latest. South of the Chang Jiang, they end in early to mid-March, 4 April at the very latest. On average, the freezing frost season ends around the end of March or early April north of the Chang Jiang, and around the end of March south of the Chang Jiang. In autumn freezing frost occurs in mid-November, on average, in the area north of the Huai, and in late November in the area between the Chang Jiang and the Huai. In the area south of the Chang Jiang, it occurs in late November or early December. At the earliest, it occurs around the end of

October north of the Huai, and around early November elsewhere. The first frost occurs everywhere about 10 or 15 days before the beginning of the freezing frost season. In Jiangsu Province, areas prone to freeze damage are Feng and Pei counties in western part of the area north of the Huai, and the area between Guanyun and Shuyang in the western part of the area north of the Huai. Second is northern and southern coastal areas, the area around Taizhou, and the high sandy soil area of Rugao County. South of the Chang Jiang, frost damage is lightest in the Lake Tai area.

(5) Hail

Hailstorms are a local weather phenomenon of considerable destructiveness. There are more than three hailstone areas in Jiangsu: (1) Ganyu - Guanyun (or Guannan) - Xiangshui - Yancheng (or Lianshui) - Dafeng (or Huaian); (2) Haian - Rugao - Nantong - Rudong; (3) Feng County (or Pei County) - Pi County (or Xuzhou) - Suining. Usually hailstorms travel from the southwest to the northeast. Strike areas and intensity: In the areas in which they rise (i.e. their place of origin) and come to an end, their intensity is small, but in the middle of affected areas, their intensity is great and commonly the area is shaped like a long oval. "Disastrous" hailstorms are concentrated in May and June when the spring season is turning into summer. They occur most frequently during late May and early June, for which reason there is a saying that "hailstones striking wheat." Most hailstorms occur in the afternoon or the first half of the night. Hailstorms are frequently accompanied by torrential rains and strong winds, and though limited in area, the damage they cause is very great. Preliminary statistics show that hailstorms can continue for several days, the longest one having been 3 days.

Section 3. Agricultural Hydrology

Quantity of rainfall and surface runoff in Jiangsu Province are fairly abundant. In addition, the crisscrossing network of rivers, the lakes, the catchments, and the ponds that dot the landscape permit both regulation and storage for use of runoff locally and of water from elsewhere to supplement it, all of which benefits agricultural production. Nevertheless, Jiangsu Province's agricultural hydrology is fairly complex, the main problems being an imbalance in areas having water resources and seasonal distribution. In some places, rivers external to the province (mostly in the area north of the Huai) may be used, but they are not entirely dependable. In addition, local control of the Huai, Yi, Shu, and Si rivers lower reaches, where the volume of water from elsewhere is great, is a major task in order to prevent floods. A great amount of water conservancy construction must continue to be done to promote what is beneficial and eliminate what is harmful, thereby increasing consistently high yields in agriculture.

Agricultural Region	Typical Station	Average Annual Temperature (°C)	Average Temperature during Coldest 10 Days: Lowest	Average Temperature during Coldest 10 Days: Extreme Value	Extreme Minimum Temperature (°C): Average	Extreme Minimum Temperature (°C): Earliest	Lowest Temperature < 0°C, Last: Average	Lowest Temperature < 0°C, Last: Earliest	Lowest Temperature 0°C, Final Day: Average	Lowest Temperature 0°C, Final Day: Latest	First Frost: Average	First Frost: Earliest
Xuzhou Area	Ganyu	13.1	-3.9	-5.8	-13.4	-19.5	11/11	23/10	1/4	11/4	1/11	17/10
	Guanyun	13.4	-3.4	-5.9	-14.3	-21.7	12/11	23/10	3/4	18/4	28/10	15/10
	Xuzhou	13.9	-3.7	-8.6	-13.8	-23.3	11/11	23/10	31/3	7/4	4/11	22/10
	Suining	13.9	-3.3	-8.3	-13.0	-22.9	14/11	23/10	28/3	9/4	5/11	15/10
	Shuyang	13.6	-3.7	-6.3	-14.0	-23.1	11/11	23/10	1/4	9/4	26/10	15/10
	Qingjiang	14.0	-2.9	-7.9	-12.3	-21.5	17/11	28/10	27/3	4/4	1/11	15/10
	Siyang	14.0	-3.2	-10.9	-11.9	-19.4	16/11	28/10	28/3	9/4	1/11	15/10
	Sihong	14.2	-3.4	-10.7	-14.5	-22.9	15/11	28/10	30/3	11/4	31/10	15/10
Coastal Area	Sheyang	13.7	-2.1	-4.2	-10.6	-15.0	20/11	6/11	26/3	6/4	11/11	23/10
	Dafeng	14.1	-1.6	-3.1	-9.5	-12.7	21/11	9/11	29/3	11/4	8/11	22/10
	Dongtai	14.4	-1.2	-3.9	-8.9	-11.8	25/11	7/11	25/3	6/4	8/11	22/10
	Qidong	14.9	0.0	-1.8	-7.8	-10.8	27/11	9/11	16/3	4/4	13/11	25/10
Lixia He Area	Funing	13.8	-2.7	-6.4	-12.2	-15.9	18/11	5/11	28/3	7/4	6/11	17/10
	Yancheng	14.3	-1.8	-3.6	-10.7	-14.3	22/11	7/11	27/3	11/4	8/11	24/10
	Xinghua	15.0	-0.9	-2.5	-8.6	-14.9	29/11	9/11	11/3	3/4	12/11	25/10
	Gaoyou	14.6	-1.5	-5.5	-10.4	-18.5	21/11	7/11	22/3	6/4	8/11	22/10
Along the Chang Jiang	Taizhou	14.7	-1.1	-5.5	-9.5	-19.2	23/11	7/11	20/3	4/4	10/11	24/10
	Yangzhou	14.8	-1.4	-6.0	-10.2	-17.7	23/11	8/11	23/3	5/4	10/11	23/10
	Nantong	15.0	-0.1	-2.3	-7.8	-10.8	30/11	9/11	17/3	4/4	11/11	25/10
	Yangzhong	15.1	-0.5	-1.6	-8.5	-10.7	24/11	9/11	15/3	4/4	12/11	23/10
Zhenjiang - Yangzhou Area	Xuyi	14.6	-2.5	-8.7	-12.0	-18.6	17/11	28/10	22/3	6/4	27/10	15/10
	Zhenjiang	15.4	-0.5	-4.2	-8.5	-12.0	1/12	9/11	10/3	3/4	13/11	29/10
	Nanjing	15.4	-0.9	-5.1	-9.9	-14.0	21/11	9/11	18/3	3/4	9/11	23/10
	Jurong	15.0	-1.0	-6.0	-9.9	-16.7	22/11	8/11	15/3	4/4	13/11	28/10
	Lishui	15.5	-0.7	-5.0	-9.6	-17.9	26/11	8/11	10/3	29/3	10/11	23/10
Lake Tai Area	Liyang	15.4	-0.4	-4.2	-9.0	-17.9	28/11	9/11	9/3	1/4	9/11	23/10
	Danyang	14.9	-0.9	-5.7	-9.3	-18.9	23/11	8/11	18/3	1/4	13/11	28/10
	Jintan	15.2	-0.7	-5.8	-9.1	-16.0	27/11	10/11	18/3	4/4	15/11	29/10
	Jiangyin	15.2	-0.2	-3.0	-8.4	-12.6	26/11	8/11	20/3	16/4	11/11	23/10
	Wuxi	15.4	0.0	-2.4	-8.2	-12.5	29/11	9/11	14/3	4/4	9/11	27/10
	Suzhou	15.8	0.4	-2.0	-7.1	-9.8	1/12	10/11	9/3	3/4	15/11	29/10
	Changzhou	15.3	-0.5	-4.8	-9.0	-15.5	29/11	9/11	16/3	4/4	12/11	28/10
	Wuxian-Dongshan	15.9	-0.8	-0.6	-6.1	-8.7	8/12	10/11	4/3	1/4	19/11	27/10
Years of Record		1955~1974									1961~1973	

Continuation 1

Agricultural Region	Typical Station	Final Frost Average	Final Frost Latest	Frost Free Period (Days)	Freezing Free Period (Days)	Stabilized at ≥3°C First Day	Stabilized at ≥3°C Last Day	Stabilized at ≥3°C Interval	Accumulated Temperature	Stabilized at ≥10°C First Day	Stabilized at ≥10°C Last Day	Stabilized at ≥10°C Interval	Accumulated Temperature
Xuzhou Area	Ganyu	3/4	11/4	212	142	7/3	29/11	268	4766	9/4	5/11	211	4347
	Guanyun	5/4	18/4	205	143	6/3	30/11	270	4857	8/4	6/11	213	4459
	Xuzhou	30/3	18/4	219	141	3/3	1/12	274	5052	5/4	5/11	215	4598
	Suining	29/3	18/4	221	135	5/3	4/12	275	5012	6/4	5/11	214	4546
	Shuyang	5/4	18/4	202	142	8/3	30/11	268	4906	7/4	6/11	214	4461
	Qinjiang	4/4	18/4	211	131	5/3	4/12	275	5009	6/4	8/11	217	4550
	Siyang	2/4	19/4	211	133	5/3	4/12	275	4998	6/4	7/11	216	4554
	Sihong	1/4	18/4	212	136	5/3	3/12	274	4865	5/4	8/11	218	4691
Coastal Area	Sheyang	31/3	18/4	225	127	5/3	7/12	278	4920	8/4	9/11	216	4448
	Dafeng	4/4	18/4	216	129	3/3	4/12	277	5007	5/4	12/11	222	4581
	Dongtai	1/4	18/4	221	121	2/3	11/12	285	5117	6/4	11/11	220	4627
	Qidong	5/4	19/4	220	110	22/2	16/12	298	5294	4/4	17/11	228	4769
Lixia He Area	Funing	3/4	18/4	219	131	6/3	3/12	273	4944	6/4	8/11	217	4513
	Yancheng	3/4	18/4	219	126	4/3	7/12	279	5046	7/4	10/11	218	4574
	Xinghua	26/3	10/4	230	103	25/2	14/12	293	5345	3/4	13/11	225	4818
	Gaoyou	30/3	18/4	222	122	27/2	12/12	289	5213	5/4	11/11	221	4711
Along the Chang Jiang	Taizhou	31/3	18/4	223	118	26/2	14/12	292	5241	5/4	11/11	221	4710
	Yangzhou	31/3	18/4	225	121	28/2	13/12	289	5277	3/4	10/11	222	4742
	Nantong	1/4	16/4	221	108	27/2	15/12	292	5274	5/4	16/11	226	4756
	Yangzhong	27/3	16/4	230	112	23/2	12/12	293	5349	2/4	15/11	228	4851
Zhenjiang-Yangzhou Area	Xuyi	9/4	18/4	200	126	28/2	6/12	282	5212	3/4	9/11	221	4739
	Zhenjiang	26/3	18/4	231	100	23/2	16/12	296	5446	2/4	15/11	228	4918
	Nanjing	29/3	18/4	226	118	23/2	13/12	295	5434	1/4	12/11	226	4897
	Jurong	23/3	11/4	234	114	24/2	14/12	294	5365	3/4	12/11	224	4819
	Lishui	22/3	10/4	234	105	22/2	14/12	296	5486	1/4	13/11	227	4946
Lake Tai Area	Liyang	31/3	19/4	223	102	22/2	15/12	297	5458	2/4	13/11	226	4876
	Danyang	25/3	11/4	231	116	26/2	14/12	292	5300	2/4	10/11	223	4755
	Jintan	26/3	11/4	232	112	23/2	14/12	295	5414	2/4	15/11	228	4884
	Jiangyin	26/3	14/4	228	115	25/2	16/12	295	5350	3/4	16/11	228	4829
	Wuxi	1/4	14/4	220	106	23/2	17/12	298	5427	2/4	15/11	228	4893
	Suzhou	25/3	18/4	234	99	21/2	21/12	304	5547	2/4	17/11	230	4957
	Changzhou	29/3	11/4	226	108	24/2	15/12	295	5378	3/4	16/11	228	4906
	Wuxian-Dongshan	23/3	11/4	241	87	18/2	20/12	306	5640	1/4	18/11	232	5056
Years of Record		1961~1973			1955~1974	1955~1974							

Continuation 2

Agricultural Region	Typical Station	Precipitation (Millimeters)								
		Total for Year	Spring		Summer		Autumn		Winter	
			Total	%	Total	%	Total	%	Total	%
Xuzhou Area	Ganyu	(985.4)	135.0	14	595.8	60	206.3	21	48.3	5
	Guanyun	930.8	159.8	17	537.4	58	167.4	18	66.2	7
	Xuzhou	841.3	141.3	17	498.2	59	151.3	18	50.5	6
	Suining	853.5	148.6	17	489.9	57	155.4	18	59.6	8
	Shuyang	940.2	164.9	18	539.0	57	178.8	19	57.5	6
	Qinjiang	959.0	172.0	18	512.9	53	187.3	20	86.8	9
	Siyang	875.8	170.1	19	477.8	55	157.9	18	70.0	8
	Sihong	(933.0)	169.3	18	528.7	57	167.6	18	67.4	7
Coastal Area	Sneyang	(1085.2)	194.1	18	594.2	55	225.9	21	71.0	6
	Dafeng	1132.3	225.8	20	561.0	50	260.1	23	85.4	7
	Dongtai	1063.7	212.1	20	528.4	50	222.9	21	100.3	9
	Qidong	(1053.0)	279.4	27	413.3	39	239.5	23	120.8	11
Lixia He Area	Funing	988.2	182.4	18	550.4	56	178.3	18	77.1	8
	Yancheng	1035.6	199.4	19	525.7	51	221.8	21	88.7	9
	Xinghua	1016.3	210.7	21	512.5	50	202.1	20	91.0	9
	Gaoyou	(1035.3)	228.6	22	506.0	49	211.1	20	89.6	9
Along the Chang Jiang	Taizhou	1069.7	230.8	22	496.2	46	234.5	22	108.2	10
	Yangzhou	1040.1	241.6	23	465.0	45	224.9	22	108.6	10
	Nantong	1032.5	247.9	24	450.2	44	213.2	21	121.2	11
	Yangzhong	1094.6	268.0	24	472.9	44	254.5	23	99.2	9
Zhenjiang-Yangzhou Area	Xuyi	927.9	179.4	19	500.1	54	169.1	18	79.3	9
	Zhenjiang	1048.9	252.6	24	446.7	43	234.0	22	115.6	11
	Nanjing	992.0	267.1	27	424.1	43	186.9	19	113.9	11
	Jurong	1031.8	261.1	25	448.8	44	208.4	20	113.5	11
	Lishui	1066.5	300.8	28	451.8	42	195.1	18	118.8	12
Lake Tai Area	Liyang	1132.0	312.3	28	452.2	40	221.2	20	146.3	12
	Danyang	1049.7	265.7	25	446.6	43	218.1	21	119.3	11
	Jintan	1068.6	279.1	26	440.1	41	239.9	23	109.5	10
	Jiangyin	1018.1	264.1	26	415.0	41	216.0	21	123.0	12
	Wuxi	1036.6	285.7	28	416.1	40	201.5	19	133.3	13
	Suzhou	1066.2	295.6	28	395.3	37	230.3	22	145.0	13
	Changzhou	1062.4	277.4	26	447.0	42	206.9	19	131.1	13
	Wuxian-Dongshan	1110.5	333.7	30	385.2	34	253.8	23	137.8	13
Years of Record		1953~1972								

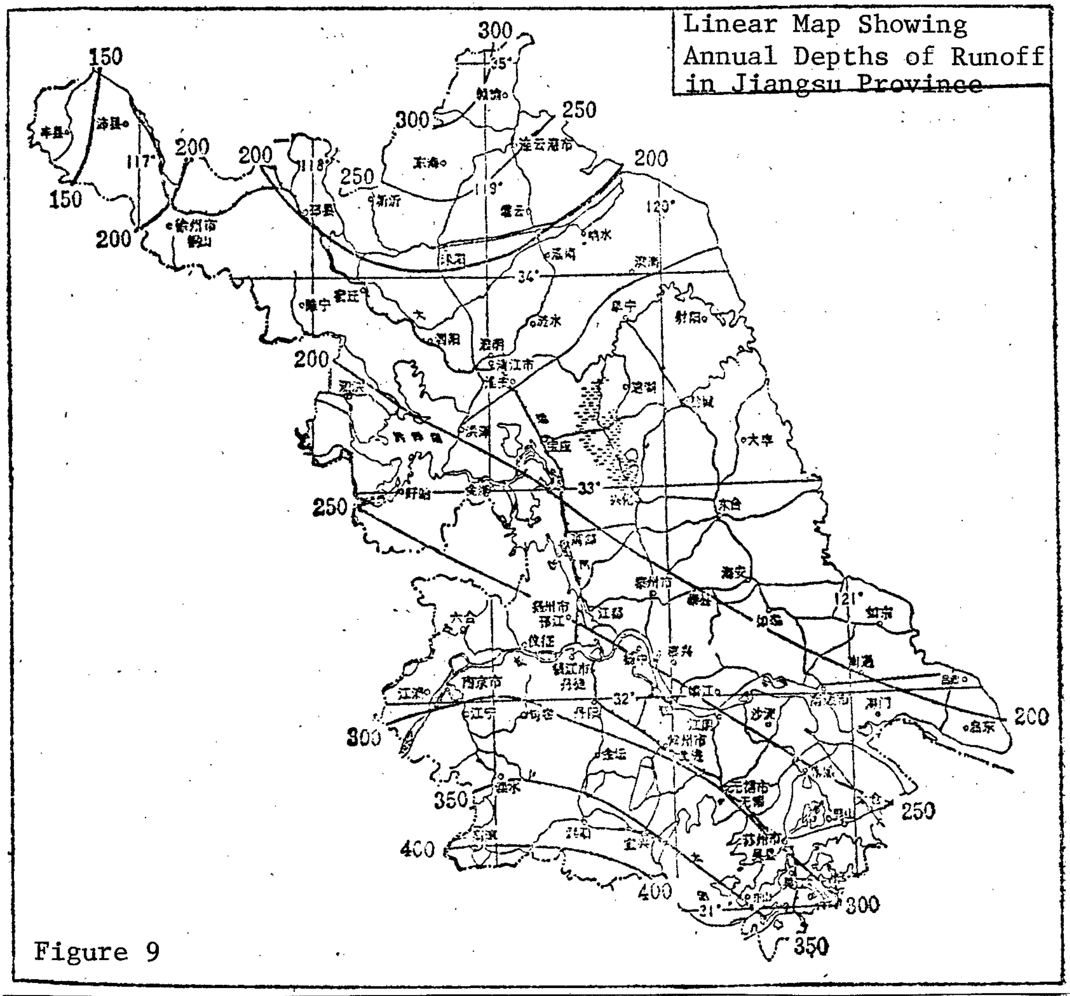
Explanation: The small number of figures in parentheses represent years for which statistics are incomplete.

1. Surface Water

(1) Surface Runoff Resources

Jiangsu Province's Surface Runoff Resources are fairly abundant. It has been calculated that the average annual depth of runoff over many years has been 240 millimeters, or an output of water amounting to about 24.6 billion cubic meters, an average annual 240,000 cubic meters of water for every square kilometer in the province. Distribution of surface runoff resources is, for the most part, closely related to area distribution of precipitation, and to topographical conditions, the composition of surface material, and the ground cover situation. Runoff is greater in the south than in the north, and greater in hilly and mountainous areas than on the plains. In southern mountain areas where it is greatest, depth of annual runoff reaches 400 millimeters. In western areas where precipitation is least copious, it amounts to only 150 millimeters. On the broad plains areas, north of the Chang Jiang, depth is around 200 millimeters for the most party; south of the Chang Jiang, it is between 250 and 300 millimeters. In terms of nationally delineated runoff zones, Jiangsu Province is situated in the "much water zone" and the "transitional zone," differences being conspicuous between south and north. Looked at in terms of distribution of runoff from cultivated land in the various regions of the province, a striking imbalance exists. Rough calculations show that in the area south of the Chang Jiang and in hilly and mountainous areas, amount of runoff averages more than 500 to 550 cubic meters per mu. Near the Chang Jiang and the Huai, it is close to 300 cubic meters, and north of the Huai, it is near 200 cubic meters. Seasonal distribution of runoff resources is also very unbalanced. At representative stations within the province, average depth of runoff over many years was distributed throughout each year as follows: In the area north of the Huai and in the area between the Chang Jiang and the Huai where the June to September flood season predominates, it was calculated at between 85 and 90 percent or more. It was fairly balanced in mountain areas and plain areas south of the Chang Jiang, being more than 90 percent in mountain regions between March and October, and more than 85 percent in plains areas between March and September. This is basically synonymous with regional distribution of precipitation and seasonal distribution of precipitation in the province.

As a matter of fact, since runoff resources differ from one region to another, and since the closeness together of water networks and projects for pumping and storing water differ, the extent of use of surface runoff also differs. For example, the plains areas north of the Huai have few natural river networks and so the closeness of ditches has been increased in recent years as a result of drought and diversion of water over wide areas, when use of surface runoff was particularly necessary. An estimated annual average runoff of about 5.8 billion cubic meters occurs throughout this region (not including hilly and mountainous areas), and in future the quantity of surface runoff water and of recovered irrigation water will steadily increase. In the area between the Chang Jiang and the Huai, average annual volume of runoff is about 7.4 billion cubic meters. Of this total, the water surface area in the Lixia He area (including the area to the west of the Grand Canal), is largest, and sluice gates have been constructed in seacoastal areas, which help make use of a large volume of local runoff and return of water used in irrigation.



Linear Map Showing Annual Depths of Runoff in Jiangsu Province

Figure 9

Along the Chang Jiang, the volume of runoff and irrigation water recovered for use is fairly great; however, in reclamation areas along the seacoast, owing to the nature of the soil and the fairly heavy salinity of ground water, local runoff cannot now be used in large amounts for irrigation. However, it can be used to flush away silt to keep harbors open. The network of waterways south of the Chang Jiang and in the Lake Tai area is dense; furthermore, Lake Tai stores water, so the rate of use is fairly high there for runoff and recovered irrigation water, an estimated more than 3 billion cubic meters annually. In hilly and mountainous areas, the volume of water generated is fairly large, and facilities for intercepting and storing it are also fairly good. The main source of water for irrigation is interception and storage of local runoff. The province now has a total of 1,166 large, medium, and small reservoirs with a storage capacity totaling 2.85 billion cubic meters irrigating an area of 3.5 million mu. Dammed ponds number 368,600 with a capacity totaling 950 million cubic meters serving an irrigated area of about 1.6 million mu. It is estimated that average annual quantity of runoff in mountain and hilly areas is close to 6 billion cubic meters of which about 60 percent

is currently being intercepted and stored. The potential for their interception and storage is still fairly great.

(2) River and Lake Water Resources

In addition to receiving the surface runoff from Jiangsu Province itself, the rivers and lakes of the province also receive water from 15 provinces and regions upstream. The volume of incoming water is very great. Such large and medium size lakes as Lake Tai, Hongze, Gaobao, Luoma and Weishan, and the Grand Canal, Huaishu He, Chuanchang He, Yan He and rivers such as the Huai, the Yi, and the Shu, which link the province north and south, form a dense water network.

Water resources in the Chang Jiang are extremely abundant. Average volume of flow for many years at the Nanjing Station has been more than 33,000 cubic meters per second. At maximum flood stage in 1954, it reached 100,000 cubic meters per second. In the driest part of the winter season, the flow is still more than 6,000 cubic meters per second, and total volume of annual runoff amounts to more than 1 trillion cubic meters. With the Lake Tai water system to regulate it, it is a most reliable source of water for irrigation. Though both banks of the Chang Jiang are affected by the rise and fall of river tides, following Liberation, through the gradual building of sluice gates for a series of ports, opening and closing them as necessary, it has been possible to divert water in or drain it away, thereby greatly increasing capabilities for diverting water from the river. Thus low lying areas along the river have conditions for automatic irrigation. Now diversion of the river's waters through pumping, and diversion through automatic flow amounts to 600 cubic meters and 1,000 cubic meters per second respectively, and annually provides a large volume of water for use to both banks of the river and to areas north of the Huai. Lake Tai is located right in the middle of this water system and has a water collection area of more than 19,000 square kilometers, a water surface area of 2,250 square kilometers, and a maximum water storage capacity of more than 4.3 billion cubic meters. It links about 180 large and small lakes and marshes and a large number of rivers and ditches to form a closely woven water network, like a spider's web, that helps regulate the water level of rivers and lakes. Its own water level varies but little, however, the average water level being around 3 meters with a variation between 0.7 and 2.4 meters for an average of about 1.2 meters, which is very favorable for irrigation.

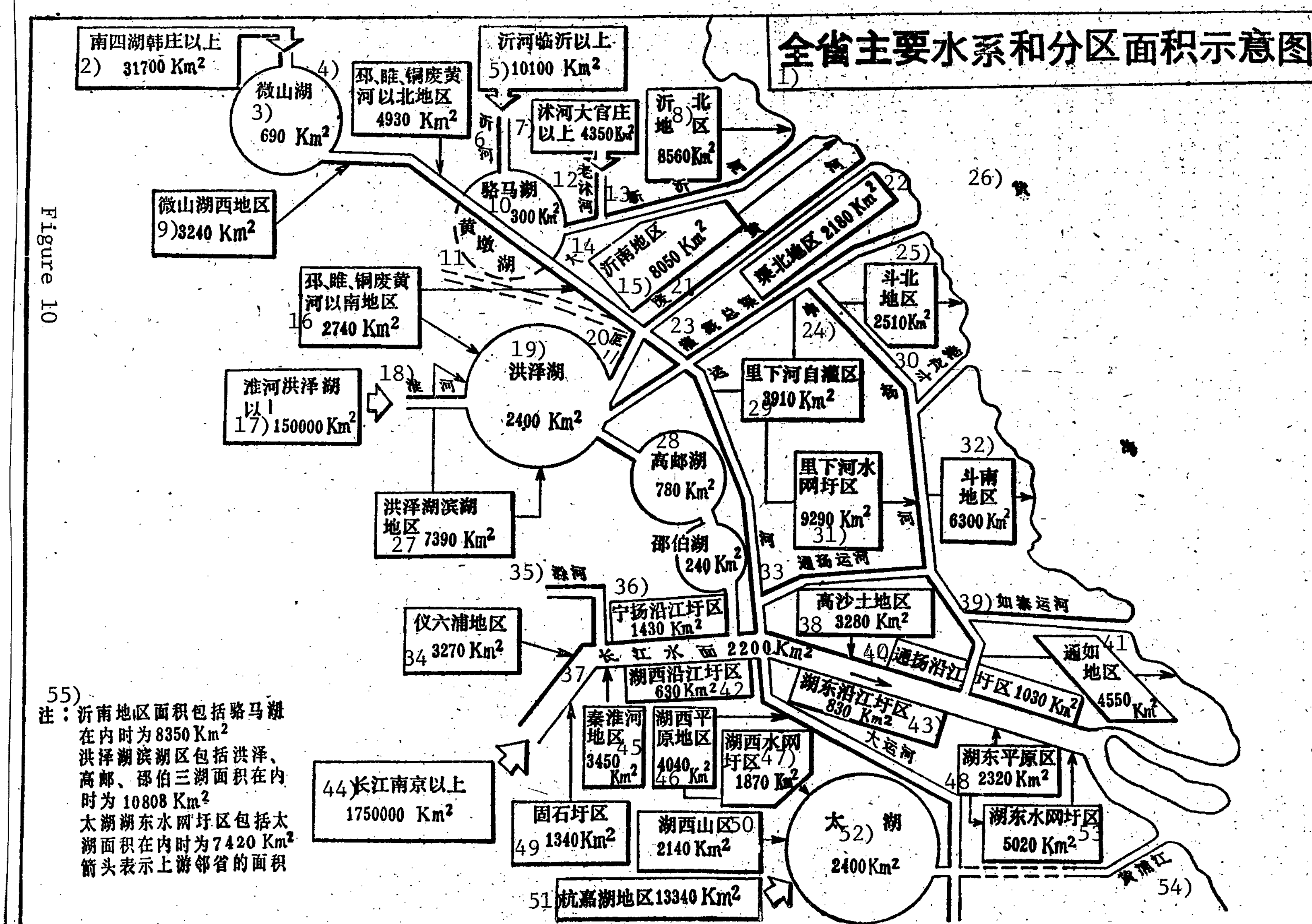
Principal problems with the Chang Jiang water source are as follows: Fairly great variation in water levels, the water level frequently being higher than surrounding land during flood seasons. This causes problems in guarding against floods and drainage of water, and the job of preventing inundations is a difficult one. During the dry season, the water level falls and diversion of water becomes difficult. For example, the highest flood level at Nanjing occurred in 1954, when it was 10.22 meters, 2.53 meters higher than the land surface on both banks. The lowest water level was only 1.7 meters, and during the 1959 irrigation season the lowest water level was 4.1 meters, which was between 3 and 3.5 meters lower than the surrounding land, causing difficulties in irrigation. In addition, as a result of the effects of river tides and the silting of a small number of ports, problems exist in both diversion and drainage of water.

On its way into Jiangsu from Anhui, the Huai River passes through Xuchi and flows into the Hungze Lake where the average annual volume of flow for many years has been about 32 billion cubic meters, accounting for 80 percent of the total amount of water entering the lake. Average annual amount of flow into the lake is about 1,000 cubic meters per second, and during the flood season in 1954, the volume of flow into the lake amounted to 15,800 cubic meters per second. Hungze Lake has a flood retention capacity totaling 12 billion cubic meters. It is a reservoir for irrigation of the plain and annually has a normal irrigation storage capacity of between 2.7 and 2.8 billion cubic meters, making it the major water source for irrigation in the province north of the Chang Jiang, and particularly north of the Huai. Furthermore since it is located high, free-flowing irrigation may be developed. However, because of the effects of a control project on the upper reaches of the Huai in Anhui Province and the development of irrigation there, in drought years and years of serious drought, the flow usually stops. Such was the case in 1959 when the flow stopped for 108 days, and in 1966 and 1977 when, as a result of serious drought, the bottom of Hungze Lake was exposed. Thus, the Huai River is characterized by undependability in use.

The river system of the Yi, Shu, and Si rivers has averaged a volume of more than 6 billion cubic meters over a period of many years. Since these rivers originate in the mountains of southern Shandong Province, their headwaters are a short ways away and the flow is swift. Torrential summer rains bring floods, and distribution of the volume of water throughout the course of a year is extremely uneven, about 85 percent of the total volume coming during the flood period, the volume being usually very small in winter and spring. Frequently these rivers stop flowing, and are thus unable to satisfy demands for water. Though Luoma, Shiliang, and Weishan lakes can store and regulate the flow of the Yi, Shu, and Si rivers, owing to current limitations on their storage capacity, water resources for irrigation are far from being as good as the two water systems of the Chang Jiang and the Huai He. When the water level of Luoma Lake is 23 meters, it stores 900 million cubic meters of water. When the water level of Weishan Lake is 33 meters, it stores 1.09 billion cubic meters. In normal years, annual volume of water from these two lakes amounts to about 800 million and 350 million cubic meters (the Jiangsu portion) respectively, far from enough to satisfy local irrigation needs. In order to assure an adequate water source for irrigation, consideration has been given to increasing the storage capacity of these lakes somewhat, and to pumping or diverting river water to supplement them. In addition, with control of the upper reaches of the Yi, Shu, and Si river systems, changes have taken place in the flood water process, and commensurate action to catch up must be taken in providing paths for flood waters and guarding against floods.

Looked at in terms of the aforestated overall surface water situation throughout the province, in the development of irrigation it is obviously necessary to surmount the two contradictions of imbalance in water sources. One is the imbalance in regional distribution, notably much in the south and little in the north, and particularly the relative lack of surface runoff, rivers, and lakes in the region north of the Huai and the inadequacy of water sources for irrigation. This requires fullest effective use of local water source conditions and consideration to rational management of water resources on a province-wide basis. The province's rivers, lakes and watercourses are close together

and linked to each other, and Chang Jiang water sources are extremely copious. Possibilities currently exist in water conservancy facilities for interrelated management of the Chang Jiang, the Huai, the Yi, and the Shu. Construction of key water conservancy projects, northward shifting of waters from the south, and eastward movement of water from the Chang Jiang, diversion of water from the Chang Jiang, and solution to problems on the Huai are all effective ways to eliminate at the source imbalances in the distribution of water resources. The second is imbalance in regional distribution of water resources. During the June to September flood season, precipitation, runoff, concentration of water in the rivers, the large volume of water, and the ferocity of onset causes many rivers to overflow their banks; this plus the effects of typhoons late in the season makes the task of guarding against inundation a difficult one. Plains and low-lying areas are prone to flooding and waterlogging, and in low-lying areas around lakes and along rivers, the flooding and waterlogging contradiction is prominent. In the dry season, meanwhile, when water levels fall, water diversion becomes difficult or water levels are inadequate. Necessary water cannot be assured, and in hilly and mountainous regions as well as on elevated plains, drought easily occurs. This requires major efforts in the construction of water conservancy in accordance with the laws of seasonal changes in the water situation, full use of water resources, timely transfer and storage of water in an elimination of disadvantages and a build up of advantages to achieve "water availability when drought occurs, and drainage of water when waterlogging occurs," to guarantee consistently high yields despite drought or waterlogging.



全省主要水系和分区面积示意图
1)
南四湖韩庄以上
2) 31700 Km²
微山湖
3)
690 Km²
4)
邳、睢、铜废黄河以北地区
4930 Km²
沂河临沂以上
5) 10100 Km²
沂河
6
7)
沭河大官庄以上 4350Km²
沂北地区
8)
8560Km²
微山湖西地区
9) 3240 Km²
骆马湖
10
300 Km²
11
黄墩湖
12
老沭河
13
14
沂南地区 8050 Km²
15)
21
22
渠北地区 2180 Km²
23
灌溉总渠
邳、睢、铜废黄河以南地区
16 2740 Km²
淮河洪泽湖以上
17) 150000 Km²
18)
淮河
19)
洪泽湖
2400 Km²
20
24)
25)
斗北地区
2510Km²
26)
30
斗龙港
里下河自灌区
29 3910 Km²
28
高邮湖
780 Km²
里下河水网圩区
9290 Km²
31)
32)
斗南地区
6300 Km²
洪泽湖滨湖地区
27 7390 Km²
邵伯湖
240 Km²
33
通扬运河
35)
36)
宁扬沿江圩区
1430 Km²
高沙土地区
38 3280 Km²
39) 如泰运河
仪六浦地区
34 3270 Km²
长江水面 2200 Km²
37
湖西沿江圩区
630 Km² 42
40
通扬沿江圩区 1030 Km²
41
通如地区
4550 Km²
湖东沿江圩区
830 Km² 43
大运河
秦淮河地区
45
3450 Km²
湖西平原地区
46 4040 Km²
湖西水网圩区
47)
1870 Km²
湖东平原区
48 2320 Km²
湖东水网圩区
5020 Km²
53
44 长江南京以上
1750000 Km²
固石圩区
49 1340Km²
湖西山区 50
2140 Km²
太湖
52)
2400Km²
黄浦江
54)
51 杭嘉湖地区 13340 Km²
55)
注：沂南地区面积包括骆马湖在内时为8350 Km²
洪泽湖滨湖区包括洪泽、高邮、邵伯三湖面积在内时为 10808 Km²
太湖湖东水网圩区包括太湖面积在内时为 7420 Km²
箭头表示上游邻省的面积

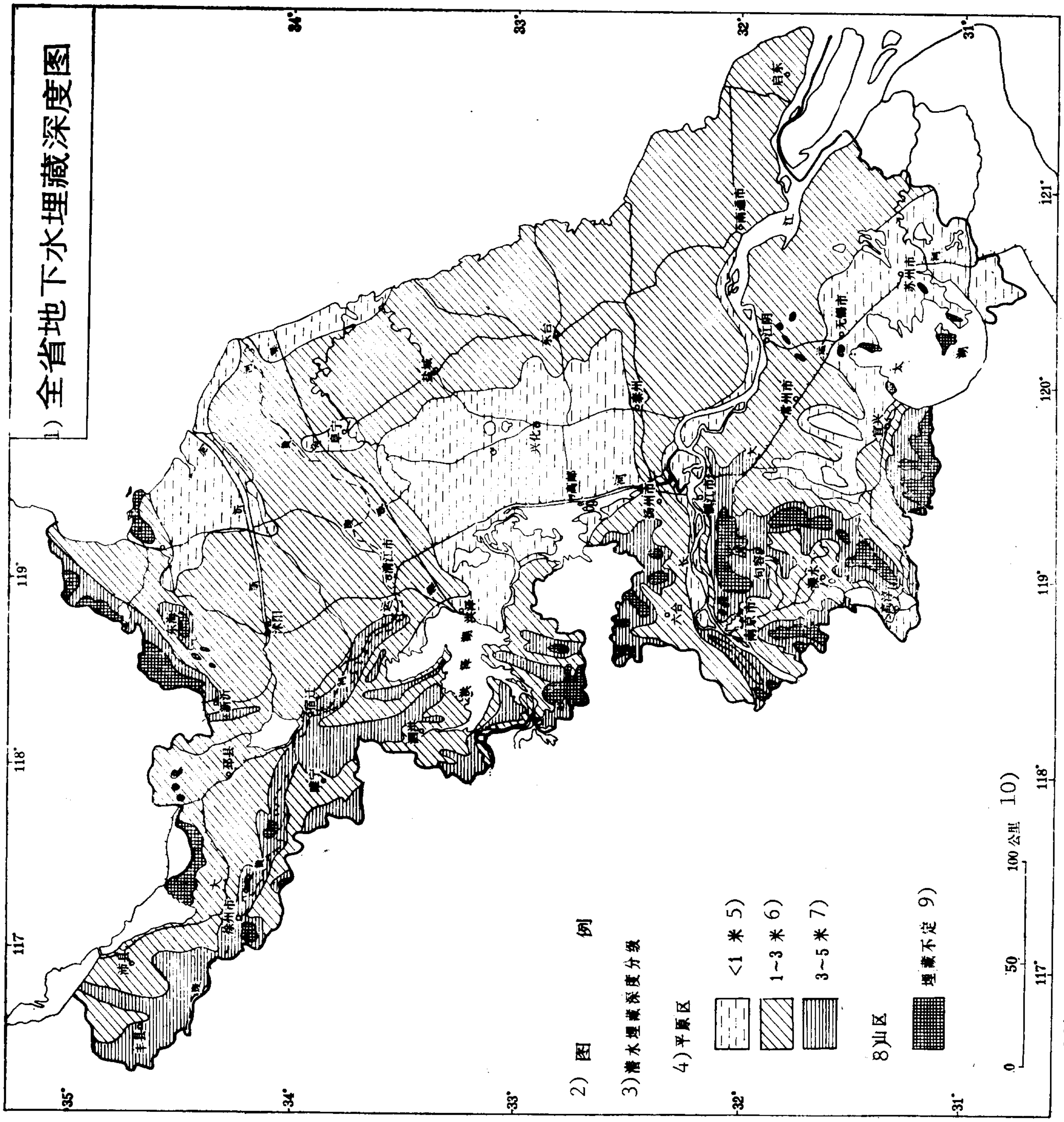
Figure 10

Key to Figure 10 on page 46

1. Schematic Diagram of Major Water Systems and Sub-Areas in the Province
2. The four southern lakes above Han Zhuang. 31,700 square kilometers
3. Weishan Lake. 690 square kilometers
4. Area north of Pi, Sui, Tong, and old bed of the Huang He. 4930 square kilometers
5. Yi He north of Linyi. 10,100 square kilometers
6. Yi He
7. Yi He above Daguanzhuang. 4350 square kilometers
8. Yibeai area. 8560 square kilometers
9. Weishan Lake western region. 3,240 square kilometers
10. Luoma Lake
11. Huangdun Lake
12. Lao Shu He
13. Xin Yi He
14. Grand Canal
15. Yinan area. 8,050 square kilometers
16. Area south of Pi, Shu, and Tong, and the old bed of the Huang He. 2,740 square kilometers
17. Area to the [character missing] of Huai He and Hongze Lake. 150,000 square kilometers
18. Huai He
19. Hongze Lake, 2,400 square kilometers
20. Er He
21. Old bed of Huang He
22. Area north of North Jiangsu Canal. 2,180 square kilometers
23. Main irrigation ditch
24. Chuanchang He
25. Doubei region. 2,510 square kilometers
26. Yellow Sea
27. Shore area of Hongze Lake. 7,390 square kilometers
28. Gaoyou Lake. 780 square kilometers
29. Lixia He self-irrigation area. 3,910 square kilometers
30. Doulong port
31. Lixia He waterway network low-lying area. 9,290 square kilometers
32. Dounan region. 6,300 square kilometers
33. Tongyang Canal
34. Yiliufu region. 3,270 square kilometers
35. Chu He
36. Ningyang low-lying area along the Chang Jiang. 1,430 square kilometers
37. Chang Jiang water surface. 2,200 square kilometers
38. High sandy soil area. 3,280 square kilometers
39. Rutai Canal
40. Tongyang low-lying area along Chang Jiang. 1,030 square kilometers
41. Tongru area. 4,550 square kilometers
42. Huxi low-lying area along Chang Jiang. 630 square kilometers
43. Hudong low-lying area along Chang Jiang. 830 square kilometers

Key to Figure 10 on page 46 [continuation]

44. Chang Jiang north of Nanjing. 1,750,000 square kilometers
45. Qin Huai He area. 3,450 square kilometers
46. Huxi Plains area. 4,040 square kilometers
47. Huxi waterway network low-lying area. 1,870 square kilometers
48. Hudong plains area. 2,320 square kilometers
49. Gushi low-lying area. 1,340 square kilometers
50. Huxi mountain area. 2,140 square kilometers
51. Hangjia Lake area. 13,340 square kilometers
52. Lake Tai. 2,400 square kilometers
53. Hudong waterway network low-lying area. 5,020 square kilometers
54. Huangpu Jiang
55. Note: When the area of the Yinan region includes Luoma Lake, it is 8,350 square kilometers. When the Hongze Lake shore area includes the three lakes -- Hongze, Gaoyou, and Shaobo -- area, it is 10,808 square kilometers. When the Lake Tai Hudong waterway network low-lying area includes the area of Lake Tai, it is 7,520 square kilometers. The arrow heads indicate upriver area of neighboring province.



1. Depths of Ground Water in Jiangsu Province
2. Legend
3. Phreatic Water Depths Beneath the Surface
4. Plains Area
5. < 1 Meter
6. 1-3 Meters
7. 3-5 Meters
8. Mountain Areas
9. Uncertain
10. Kilometers
11. Figure 11

2. Groundwater

Generally speaking, supplies of groundwater in the province are fairly copious, but their distribution is uneven. It is estimated that the shallow stratum between 30 and 50 meters below the ground surface holds water reserves of about 130 billion cubic meters, of which about somewhat more than 16 billion cubic meters may be tapped for use. The formation and dynamic changes in groundwater are conditioned by climate, topography, hydrology, the geology of the Quaternary Period, and artificial irrigation. Because the degree of influence of various factors differ, a certain regional disparity also exists in the deposits, volume and quality of water, and the effects on agriculture also vary greatly.

Phreatic water tables in Jiangsu Province are everywhere fairly high, and burial depths range from several tens of centimeters to 60 meters, in three basic situations: (1) The less than 1 meter, high water table regions: On the Lake Tai Plain, around Chao and Ge lakes, in the Lixiahe lowlands, on the flood plain on both banks of the Chang Jiang, and in Lianyun Gang and the seacoast to the east of the North Jiangsu Canal, in fairly broad distribution, accounting for an estimated 30 percent of the province's total land area, most of the water is at a depth of from 0.4 to 0.8 meters. The topography in these areas is fairly low, and it is here that surface water and ground water comingle making drainage difficult and forming high water tables. Furthermore, as a result of the diversion of a large volume of surface water for irrigation, which has increased the water supply, the ground water table has frequently been raised. (2) The 1 - 3 meter, medium high water table area: This area has the broadest distribution, and is estimated to be about 60 percent of the total land area in the province. Except for the aforementioned areas and the hereinafter stated mountain fringe terraced areas, the entire province is in this category, an overwhelming majority of the water being at a depth of from 1.5 to 2 meters. (3) The 3 - 6 meter, low water table area. This is distributed in places where the terrain is uplifted, in 1 - 2 stage terraced areas on the edges of rather heavily cut up areas on the fringes of hills, and on the flood plain of the old bed of the Huang He. The aforementioned pattern of high, medium, and low water table distribution obviously is limited by topographical conditions. Seasonal changes in the ground water table are controlled primarily by the amount of precipitation and the rise and fall of the surface water table, high water tables generally occuring during June and July, and low water tables occuring in March and April. In the Lake Tai and Lixia He area, annual change is from 0.3 to 0.5 meters; in coastal areas it is 1 to 1.5 meters, and in the area north of the Huai it is 1 to 3 meters. In the old bed of the Huang He, the extent of change is greatest, being more than 3 meters.

Phreatic water chemistry of the province is characterized principally by the effects of inundation by the sea. Remnant salinity in the warp varies from place to place, a regular pattern of change existing from east to west. Three zones may be distributed from east to west as follows. (1) The east: the coastal strip to the east of the Chuangchang He and the North Jiangsu Canal has been land for only a short historical period, and it contains large quantities of ocean water salts. In some places, even today there is contamination by the sea, and the extent of mineralization is high, generally 3 to

30 grams per liter, making it highly mineralized sodium chloride type water. (2) The central part: The Huaibei Plain, the Lixia He lowlands, and the New Delta Plain and the plain of the Chao and Ge lakes to the east of the Xuzhou hills, which has been affected by the sea in the past. Coastal lagoons are relatively dominant in the warp, and despite washing by fresh water for a long period of time, a definite salinity remains. In addition, most of these areas are located in the heart of the ground water convergency basin. Ground water supplied by the western and northern part shows increasing enrichment of chloride and sodium ion content as the distance of runoff lengthens, and a gradual heightening of mineralization of generally 1 to 3 grams per liter. Farther west, it gradually decreases to 1 gram per liter to make water heavy with carbonates and chlorides in which there is a small amount of sulfate. (3) The west: The vast hills and region of lakes and marshes to the west of the Grand Canal, which have not been inundated by the sea and are made up of continental deposits, and where conditions for drainage of runoff are rather good. Here mineralization is less than 1 gram per liter, and water is full of carbonates.

Ground water and agricultural production are closely related. In places where surface water is lacking, development of superior quality and abundant ground water resources is a major method. However, when the underground water table is too high, or when ground water contains too much salt, normal growth of farm crops will be impaired.

The Xu-Huai area. Here surface runoff is insufficient and river and lake water resources are limited, particularly so in the western part of the area. Many of the rivers stop running in certain seasons. When the rains stop, the rivers dry up and water resources are lacking. It becomes urgent that ground water resources be developed for irrigation. Survey shows that in this region ground water quality and quantity both meet irrigation requirements through three artesian aquifers: (1) The Pliocene epoch artesian aquifiers made up of semi-bonded pebbles. These aquifers are found over a fairly wide area, and their water quality is good, the degree of mineralization being less than 1 gram per liter. It is a strongly carbonate and chloride water. Water depth beneath the surface varies from place to place from 10 meters to 30 or 40 meters to 80 or 120 meters (in Feng and Pei counties in the west), to 150 meters along the eastern seacoast. (2) The Pliocene and Pleistocene epoch artesian aquifers made up of pebbles, and mostly found in the basins of the Xinyi, Suqian, northern Shuyang, Yi and Shu river basins. Such aquifers are made up of diluvial and alluvial fans of the Yi and the Shu river over a pebble base, which is 5 to 10 meters thick in most places, but has a maximum thickness of 20 meters. In the north it is found between 5 and 10 meters beneath the surface, and farther south it may be as far down as 40 meters. (3) The Pliocene and Pleistocene epoch clayey soil intercalated jiang [5673] artesian aquifier. This is found mostly in the western region in Feng and Pei counties, and in the Tong and Sui areas, where it lies from 10 to 50 meters below the surface and is concentrated in from one to four strata, each stratum being 3 to 5 meters thick. Looked at in terms of development within the region, the uplifted plain of the west lacks surface water but the rather shallowly buried, readily accessible, and fairly water-rich Pliocene and Pleistocene epoch semi-clay soil intercalated jiang [5673] bed aquifiers can become a major irrigation source. Included is the limestone hill region around Xuzhou and Tongshan

from which water resources within the limestone may be diverted for use in irrigation. In the southwest, in the area to the west and north of Hongze Lake, hills and lowlands alternate and diversion of water to the hills is rather difficult, but a source of water for irrigation exists in the Pliocene artesian pebble aquifier. This can be a principal water source for irrigation, and a combination of irrigation and drainage ditches can be used to improve ground water runoff drainage conditions so as to improve the saline-alkaline soil. At the present time, Feng, Pei, Tongshan, and Suining counties, as well as Sihong, Siyang, and Suqian counties are building a large number of irrigation wells. Annual tapping of ground water now amounts to about 800 million cubic meters, making it the major well irrigation area in the province. But the potential for further development is still rather large. In the north, on the Yi and Shu river plain, diversion of surface water from the hills is difficult, and mostly water from the Peiocene and Pleistocene epoch shallow, pebble, artisian aquifiers has to be used as a source for irrigation. In the metamorphic rock low mountain and hill area of the northeast, ground water sources are fairly lacking. Only in the upper reaches of the Qingkou He, and in the area at the foot of the Yuntai and Jinping mountains are their strips of ground water resources, but these are generally sufficient only to meet needs for drinking water.

On the sandy soil flood plain of the Huang He in this area, because the terrain slopes gently and waterway networks are few and far between, underground runoff is very slow. In addition, the climate is dry and evaporation great, and 1 to 3 meters below the surface lies a clayey intercalated base. As a result salt in the underground water readily concentrates in the surface of the land causing wide areas of saline-alkaline land. Required is a lowering of the underground water table and a hastening of the circulation of the direction of the underground water table in order to eliminate the salinity from the soil.

The Lixia He Region. In the area east of the Grand Canal, the terrain is low-lying, and ground water percolation characteristics are poor. In addition, the area receives surface water from all around making for difficulties in draining away the ground water. The water table is overly high and harmful components in the water increase impairment of crop roots and full use of soil fertility. Thus, it is necessary to vigorously improve conditions for draining away ground water in order to lower the underground water table. In this region water resources are abundant, so there is no need for development of ground water resources.

Coastal Region: Because of contamination by sea water, ground water in the shallow strata is essentially highly mineralized sodium chloride water. Water conservancy and agricultural methods are needed to hasten the purification of saline soil and prevention of the return of salinity. In the coastal region at a depth of from 120 to 150 meters below the surface are artesian freshwater aquifers of pebbles and clay from the Eocene, Miocene and Pliocene epochs with a water surge of about 20 to 60 tons per hour. Degree of mineralization is 1 to 2 grams per liter. The water is a strongly carbonate and chloride type. Water temperature is 24°C, and water quality meets requirements for supply to coastal fishing and livestock industries.

The Area Along the Chang Jiang and Lake Tai. Here surface water resources are abundant, and there is no need for tapping ground water. In places along the Chang Jiang where the terrain is relatively high, the ground water lies not very deep beneath the surface, so it produces no bad effects on agricultural production. In some of the low-lying plains areas in the area of Lake Tai, ground water percolation is poor. In addition, the area has been subjected to pressures from the rivers so the ground water lies only a short distance beneath the surface where it has long stagnated. Water temperatures are low, and ferrous ion content is high, making it of no use for the growing of farm crops. Further work must be done to improve the irrigation and drainage system so as to promote circulation of the ground water so as to improve its quality and effectively control the underground water table.

The Zhenyang Hill Area. The terrain is uplifted and water sources for irrigation inadequate. Aside from making full use of surface water resources, in places where conditions permit, thought should be given to tapping of water stored in fissures within the bedrock and from springs, as supplemental sources of water for agricultural use.

Section 4. Soil

Regional differences are fairly great in the province's biological and climatic elements, and in its geomorphological and hydrological conditions. In addition, as a result of the adaptation of general methods to local situations by the working people to farm in different ways, the direction of soil development in individual areas has changed, and soil types are fairly complex. In most places, the mother material that has formed the soil is fairly good, and natural fertility is rather high. This plus nurture of the soil by man over a long period of time has resulted in fertile, high yield soils over a fairly wide area. However, there is a fairly great difference in fertility of high yield, ordinary yield and low yield soils, and regional distribution is also very unbalanced.

1. Soil Distribution Patterns

Soil distribution in Jiangsu Province shows conspicuous zone and regional patterns.

(1) Soil Zone Distribution Patterns

Soil zone distribution patterns generally include horizontal zone distribution patterns and vertical zone distribution patterns. Inasmuch as the province straddles three biological and climatic zones with incremental increases in volume of precipitation and temperature from north to south, and gradual intensification of the role of weathering and leaching, the horizontal zone distribution pattern is fairly conspicuous. Different biological and climatic zones make up different types of soil zones. In the temperate zone it is brown earth and leached, drab soil; in the northern semi-tropical zone, it is yellow-brown forest soil, and in the mid-tropical zone it is yellow soil (also called yellow-red soil). Though not all cultivated soils are an outgrowth of zone soils, they have a certain zonality about them. For example, temperate

zone plains soils are frequently saline-alkaline, and northern semi-tropical plains soils, with the exception of soils along the seacoast, essentially saline-alkaline, while mid-tropical zone plains soils are entirely free of salinity and alkalinity. Since there are few mountainlands in Jiangsu Province, and its elevation above sea level is fairly low, the vertical distribution pattern of the soil is not prominent.

As for relative distribution of soil, i.e. changes with longitude within a certain latitude, to be specific, the pattern is one of transition from a marine climate to a continental climate. The difference in longitude in Jiangsu province is less than three degrees from east to west; consequently, relative changes are not conspicuous.

(2) Soil Region Distribution Patterns

Because of regional variations in the mother material of soil, the geomorphology, and the hydrological conditions within a biological and climatic zone, different types of soil have frequently been formed.

Within the brown forest soil zone, the weathered products of acidic granite and gneiss rock in mountainlands become brown soil, while weathered limestone, which ranges from neutral to alkaline become leached drab soil or dark limestone soil. The yellow alluvium of the Huang He Plain produced strongly calcareous yellow chao soil [7806 3390 0960], while the granite and gneiss alluvium of the Yi and Shu Plain produced non-calcareous brown chao soil [2762 3390 0960]. The fan shaped land of the Huang He flood plain becomes progressively, as one goes from top to bottom, blown sand soil, sandy soil, a combination of the two, and silt. The sandy soil geodepressions of the Huang He flood plain show fairly high concentrations of mottled alkaline soil [5363 4354 0960] as a result of the high water table and its fairly great mineralization. However, on sandy soil slopes, where the water table lies fairly deep and its mineralization is low, mostly blue sandy soil [7230 3097 0960] is found, the distribution of mottled alkaline soil being only here and there.

Within the yellow and brown soil zone, yellow and brown soils are encountered only in hilly regions, while rice paddy soil is widely distributed in valleys. Rice paddy soil from loess hills is not calcareous, but rather acidic in its reaction. Some of the rice paddy soil of the Chang Jiang alluvial plain is calcareous, but mostly it ranges from neutral to mildly alkaline. The hills, slopes, and flatlands in loess hill lands are generally composed of successive layers of loess, yellow belozem, magan soil [7456 5139 0960], and stripes of blue mud. The high flat fields of the Lake Tai Plain are made of yellow argilla, belozem, and goutou sand [3699 7333 3097]. The flat fields are made of yellow argilla, and shanxue belozem [7668 5877 4101 0960], while the low-lying diked fields are made up of green-yellow argilla, green-purple argilla, and wushan soil [3527 1472 0960]. Marshy fields are made up of blue argilla and grass stubble soil [5430 3257 0960]. In hilly places where the underground water table is low, mostly submergic paddy soil like pulverized soil [1420 4720 0960] is found. In low-lying lake and marshlands where the underground water table is high, the soils are mostly gley rice paddy soil such as yashi

soil [7700 1452 0960], while on the plains where the underground water table is medium, most soils are temporary submergic paddy soils such as yellow argilla.

Within the yellow soil zone, the mother material in the soil of the low hills is sandstone, quartzite, granite, and andesite prophyrite; thus the soil is weathered products of acidic rocks. The soil is fragmental yellow soil, and at the foot of hills there is a deep layer of red loess [4767 7806 0960].

2. Major Soil Types and Their Characteristics

Jiangsu Province's soil types are fairly complex. On the basis of their utilization characteristics, they may be divided into wetland soils, dryland soils, forestland soils, and wastelands soils.

(1) Wetland Soils

Wetland soils means mostly rice paddy fields, which are distributed principally in the region south of the Huai He. Statistics from a 1959 soil survey show this area to total about 31.48 million mu in which are 15 major categories of soils, each of them containing various kinds of soil.

1. Yellow Belozem Soil: This is the belozem type paddy soil of the Zhenyang hill region, which includes finely pulverized belozem, stiff belozem, shanxue belozem [7668 5877 4101 0960], and black belozem. These developed out of subordinate loess mother material and are found mostly in hill and hillside fields, and in branches of alluvial fields over an area of about 3.17 million mu. As a result of a long period of continuous irrigation, the clay particles have eroded and diminished while the coarse grit content has correspondingly increased. Soil structure is not good, and it is prone to becoming syrupy and stiff, and it neither maintains fertility well nor is it easily fertilized. Its organic content is not high, generally only 1 to 1.5 percent. Its phosphate content is low, total phosphate being only 0.05 to 0.12 percent, and quick acting phosphate is mostly less than five parts per million. Finely powdered belozem and stiff and viscous belozem soils are both low yield soils, the latter being the worst of the two. After it has been improved and brought along, it can become a shanxue belozem or a black belozem of fairly high fertility.

2. Magan Soil [7456 5139 0960]. This is the temporary submergic paddy soil of the Zhenyang hill region. Its most important varieties are magan soil and xuesi magan soil [5877 4828 7456 5139 0960]. It has developed out of secondary loess mother material and is frequently found in alluvial fields over an area of about 1.92 million mu. It is somewhat sticky in nature, but not syrupy or stiff. It has good fertility preservation and fertility acceptance characteristics. Organic content is around 1.5 percent, and its phosphate deficiency is not as severe as that of yellow belozem. In the case of xuesi magan soil, in particular, porosity is good, and it is suitable for growing either paddy rice or wheat.

3. Blue Mud Stripe: This is the gley paddy soil of the Zhenyang hill region, whose varieties include blue mud stripe, blue sand bailuosi soil [7230 3097 4101 5828 4828 0960], wunijin [3527 3136 4585] and goupi blue mud [3699 4122 7230 3136]. The mother material for this soil is a clay alluvium, found largely in low-lying river areas at the lower edges of alluvial hills over an area of about 850,000 mu. Since drainage conditions are poor, the soil is heavy and difficult to plow. Though the soil has inherently high fertility, inasmuch as it is cold and wet with poor porosity, effective nutrients are not readily useable.

4. Yellow Argilla. This is a temporary submergic paddy soil on the Lake Tai Plain, which includes shanxue yellow argilla, yellow argilla, and stiff yellow argilla. It has developed out of lacustrine deposits and is distributed principally in flatland and high flatland fields over an area of about 3.32 million mu. The mellow soil layer is thick and the underlayer of fields solid. Organic content is as high as 1.8 to 2.5 percent, or even greater than 3 percent. Total nitrogen is 0.12 to 0.18 percent, and both phosphate and potash content are fairly abundant. Acceptance of fertilizer and preservation of fertility are good. Quality is not excessively clayey, the clay particle content being 20 to 30 percent. Porosity is good, the soil both conserving water and releasing water. It is also readily plowable and suited to the growing of paddy rice or wheat.

Belozem. This is the paddy field belozem of the Lake Tai Plain, which includes shanxue belozem, belozem and illuvial sand [3244 3559] belozem. This soil is an outgrowth of lacustrine deposits and is distributed in areas mixed with yellow argilla over an area of about 2.25 million mu. Below the plow plan is a belozem plan, the coarse and powdered sand content of which is fairly high. The organic content is around 1.5 percent and total nitrogen content is below 0.1 percent. Illuvial sand belozem is particularly likely to be syrupy and stiff, and it is one of the low yield soils of the Lake Tai Plain. With improvement, it can become a shanxue belozem of fairly high fertility.

6. Wushan Soil [3527 1472 0960]. This is the mildly gley paddy soil of the Lake Tai Plain lowlands and includes shanxue wushan soil, wushan soil and shutou [4549 7333] wushan soil. The mother material from which the soil was formed was lacustrine deposits, and the terrain over which it is distributed is lower-lying than the yellow argilla, an area of about 1.53 million mu. The soil layer is rather thick and the soil somewhat clayey in quality. Its clay particle content is between 20 and 25 percent; its organic content is between three and five percent, and it generally has strong capacity to hold water and preserve fertility. The plowability and acceptance of fertilizer of shanxue wushantu is rather good. But when fields become dry, shutou wushan soil is prone to form a prismatic structure, which drains away water and fertility. When dry, it is hard; when wet, it is sticky. Much effort is required to plow it, and because of its low temperature, nutrients are not easily put to use.

7. Green Purple Argilla. This is the paddy soil of the Lake Tai Plain lowlands and lake marshlands. It includes green purple argilla, green yellow

argilla, and green argilla. The mother material from which the soil was formed was also clayey lacustrine deposits spread over an area of about 2.37 million mu. The soil is heavy, its clay particle content being more than 25 percent. Plowability and porosity are rather poor. Preservation of fertility is strong and its inherent fertility is high. Organic content is about two to four percent; total nitrogen content is about 0.15 to 0.2 percent, potash is abundant, but phosphate is rather deficient.

8. Silt argilla. This is the clayey temporary submergic paddy soil along the Chang Jiang. It includes lung [1096] argilla and chanjiao [4961 5183] soils, formed from Chang Jiang alluvium and covering an area of about 2.5 million mu. It is mildly calcareous. It tends to be clayey and has rather poor porosity. Nutrient content is rather high; organic materials runs from 1.5 to 2.0 percent, and total nitrogen is 0.1 to 0.2 percent.

9. Interculated Sandy Soil [1140 3097 0960]. This is a temporary submergic, loamy texture paddy rice soil found in the region along the Chang Jiang. It includes ridges interstratified with sand [1096 1140 3097], sand interstratified with ridges, and high sandy soil]7455 3097 0960]. The mother material from which the soil was formed was Chang Jiang alluvium. It covers an area of about 2 million mu. Both organic content and total nitrogen are somewhat lower than in the silt argilla; however, because of the sand in the clay, porosity is good. It is suitable for the planting of rice, wheat, or cotton.

10. Illuvial Soil [3244 3559 0960]. This is sandy, temporary submergic paddy rice soil along the Chang Jiang. It includes illuvium, and stiff but sandy [ban er sha [2647 5079 3097] soil. It is a paddy soil formed during a fairly short period from Chang Jiang alluvium, covering an area of about 650,000 mu. Since the soil quality is overly sandy, it is prone to caking and hardening. Organic content is only about one percent and fertility tends to be low.

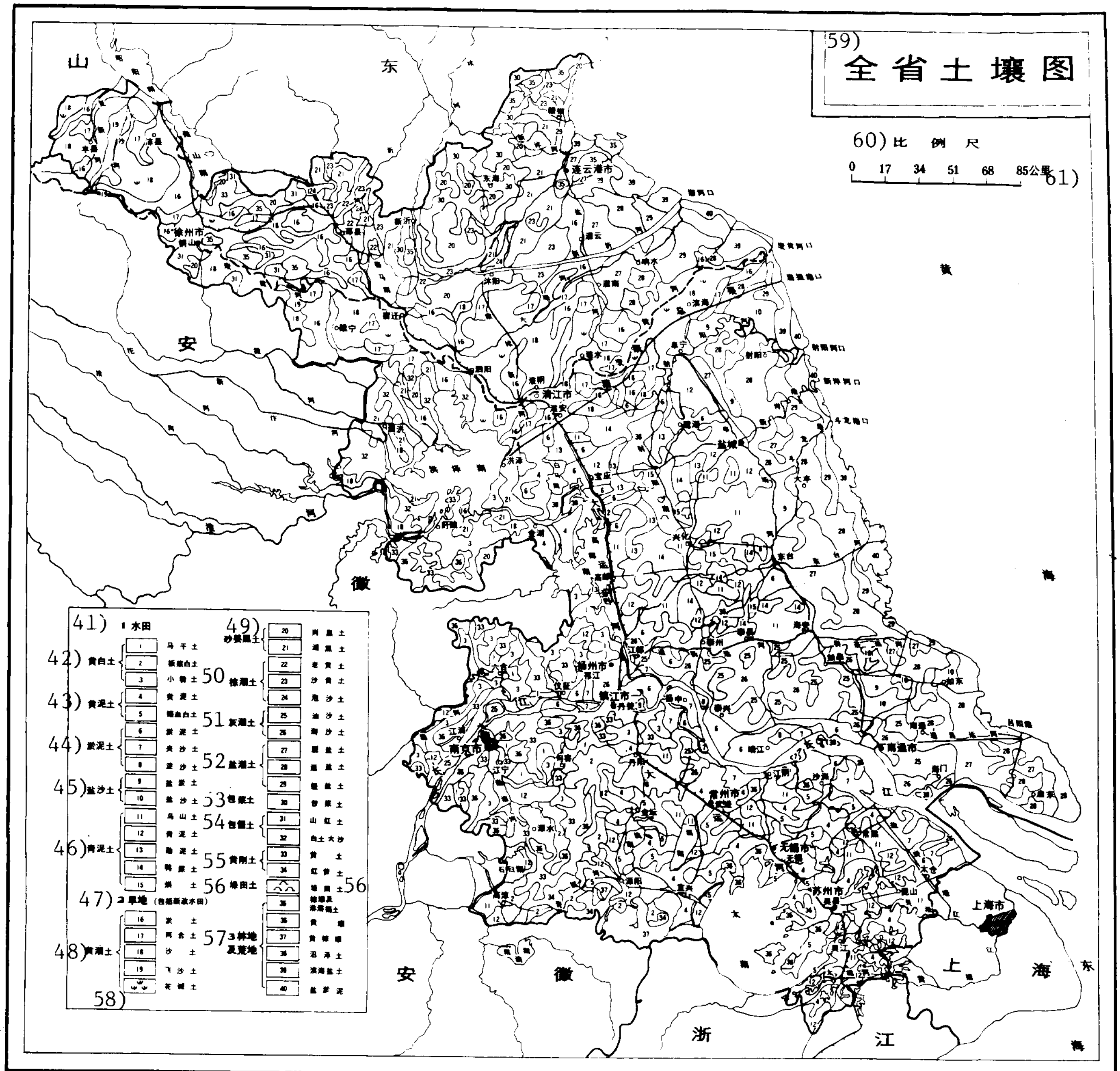
11. Red Sandy Soil [4767 3559 0960]. This is temporary submergic paddy soil from the Lixia He region. It includes blue sand soil [0530 3559 0960] and red sandy soil, which developed out of lacustrine deposits or artificially piled deposits, and covers an area of about 4.03 million mu. Extent of slaking is fairly high; organic content is from two to three percent; total nitrogen is from 0.12 to 0.15 percent; total phosphate is from 0.1 to 0.14 percent; and total potash is about two percent. Coarse and pulverized sand content runs to between 45 and 55 percent; however, clay particle content is also high (it is not a true sandy soil); soil porosity is good, and it is suited to the planting of paddy rice or wheat.

12. Pulverized Bentonite [1420 4720 3364 0960]. This is a caked special variety of temporary submergic paddy soil in the area of the Lixia He, which includes pulverized bentonite and baijiao soil [4101 5183 0960]. The mother material from which the soil was formed was lacustrine deposits covering an area of about 740,000 mu. Fertility tends to be low and surface soil has an organic content of under two percent. The coarse and powered sand content is fairly high, and it cakes and hardens.

13. Garlic Clove Soil [4615 3904 0960]. This is a gley type paddy soil in the Lixia He region. It includes garlic clove soil, yellow clay, and black clay whose mother materials were clayey lacustrine deposits and alluvium covering an area of about 2.64 million mu. For the most part, it developed out of a fully composted field chalk mud [3578 3371 3944 1019 3136] that was uplifted, and gleying characteristics are fairly conspicuous, and extent of gleying of the black clay being greatest, the garlic clove soil second, and the yellow clay soil least. Nutrients are good; organic content is about 2.5 to 4.0 percent, total nitrogen is 0.14 to 0.22 percent, but because porosity is fairly poor, the inherent fertility cannot be used to the full. The soil quality is heavy and difficult to till, and it loses water easily.

14. Yashi Soil [7700 1452 0960]. This is mostly a boggy paddy soil in the Luxia He region, which had been composted field soil including yashi soil, black baked soil [7815 3530 0960], and the grass stubble soil [5430 3257 0960] of the Lake Tai marshy field area may also be included in it. The mother material from which this soil was formed was likewise lacustrine deposits and alluvium covering an area totaling about 2 million mu. Gleying characteristics are rather noticeable. Organic content is as high as between four and eight percent, and total nitrogen runs to 0.16 to 0.30 percent; yet, because of poor porosity, inherent fertility cannot be readily used to full advantage.

15. Saline Sandy Soil. This is a temporary submergic paddy soil developed from saline mother material. On the basis of differences in coarseness of the warp, it may be divided into saline sandy soil and saline silt, which cover an area of about 1.41 million mu. In some places where ground water tables are fairly high, mineralization is also great, and where drainage and irrigation conditions are poor, this may result in heavy renewed salinization of the soil. Soil fertility differs to a fairly great extent depending on how well it has been maintained.



62) 图 13

[Key to Figure 13 on following page]

Key to Figure 13:

1. Magan Soil
2. Stiff Belozem
3. Pulverized Soil
4. Yellow Argilla
5. Shanxue Belozem
6. Puddly Soil
7. Intercalated Sandy Soil
8. Illuvial Soil
9. Salty Silt
10. Saline Sandy Soil
11. Wushan Soil
12. Blue Argilla
13. Qin Argilla
14. Yashi Soil
15. Baked Soil
16. Silt
17. Two Combined Soils
18. Sandy Soil
19. Blown Sand
20. Black Hill Soil
21. Lacustrine Black Soil
22. Old Loess
23. Sandy Loess
24. Soaked Sandy Soil
25. Putty Soil
26. Lacustrine Sandy Soil
27. Desalinated Soil
28. Resalinated Soil
29. Lightly Saline Soil
30. Mucky Soil
31. Mountain Red Soil
32. Belozem Dasha
33. Loess
34. Red Loess
35. Fields built on low marshlands
    Brown Earth and Leached Brown Soil
36. Yellow Earth
37. Yellow-Brown Forest Soil
38. Bog Soil
39. Seashore Saline Soil
40. Saline Silt
41. Wetlands
42. Yellow Belozem
43. Yellow Argilla
44. Puddly Soil
45. Saline Sandy Soil
46. Blue Argilla
47. Drylands
48. Yellow Lacustrine Soil
49. Sajong Black Earth
50. Brown Lacustrine Soil
51. Lacustrine Spodosol
52. Lacustrine Saline Soil
53. Mucky Soil
54. Stiff Soil
55. Huanggang Soil
56. Fields built on marshy lowlands
57. 3. Forest Soil and Wasteland
58. Mottled Alkaline Soil
59. National Soil Map
60. Legend
61. Kilometers
62. Figure 13

(2) Drylands Soils

Drylands soils are distributed mostly on the Xu-Huai Plain in northern Jiangsu and along the coastal plain. There are also some in the hilly land of the hill and mountain region. Some of these have been changed from drylands to wetlands in recent years.

1. Yellow Chao Soil. This is a dryland soil developed out of Huang He flood deposits, which includes silt (honghua silt [4769 5363 3226], silt, and aerating silt [3345 7364 3226]), two combined soils, combined sands [3097 0357 0678 0960] and combined silts [3226 0357 0678 0960]), sandy soil (blue sandy soil [7230 3097 0960] and sandy soil), and running sandy soil (paoshatu [3133 3097 0960] and blown sandy soil). They cover an area of about 13.78 million mu, sandy soils accounting for about 5.32 mu, silt soils accounting for about 5.64 million mu, two combined soils accounting for about 2.23 million mu, and

blown sandy soils accounting for about 590 million mu. Yellow chao soils are strongly calcareous, their calcium carbonate content amounting to from 5 to 15 percent. Neither organic content nor total nitrogen content is high, being 0.5 to 1.2 and 0.05 to 0.08 percent respectively. Total phosphate is highest at from 0.12 to 0.14 percent, but effective phosphate is low. Sandy soils are prone to salinization and alkalinization to become mottled alkaline soil [5363 4354 0960]. Silt soils are rather strongly clayey. Two combined soils are half silt and half sand whose soil quality is moderate. Sandy soils are loose in character and prone to hardening following rains. Blown sand soils lack structure, and when dry are likely to be blown about by the wind.

2. Mottled Alkaline Soils [5363 4354 0960]. These are a sub-category of yellow chao soils and include sandy alkalines, wa [3907] alkalines, saline alkalines and bittern [7767] alkalines, most of which are in areas with many kinds of sands. They once covered an area of 5.6 million mu, but now about one-half of that area has been improved to become sandy soil. In this type soil, the topsoil accumulates salt seasonally and has a saline content of from 0.1 to 0.6 percent. Wa alkalines contain alkali (sodium carbonate) and produce an alkali reaction of pH 9 - 10. Soil quality is overly sandy, the clay particle content often being as low as 10 percent. Organic content is quite low, usually around 0.5 percent, and nitrogen, phosphate, and potash are rather deficient.

3. Sajong Black Earth. This developed in the old alluvium that preceded the flooding of the Huang He, and consists of old drylands soils in a black soil stratum and a sajong stratum. It includes black hill soil, black lacustrine soil, and the two black soils combined. It covers an area of about 5.25 million mu. Despite the black color of this soil, its organic content is not high, being around one percent. Both total nitrogen and total phosphate tend to be low, being at 0.06 to 0.08 percent and 0.08 to 0.10 percent respectively. It is even more deficient in quick acting phosphate. Soil quality is comparatively clayey and not readily plowable. During drought the soil cracks and allows moisture to escape, but it maintains fertility rather well.

4. Brown Chao Earth [2762 3390 0960]. This is a dryland soil formed from the alluvium of the Yi and Shu rivers containing sandy yellow soil, aged yellow soil, and aged soil, and covering an area of about 1.5 million mu. Its fertility is about the same as that of yellow tidal soil, but it is not as seriously deficient in phosphate as yellow tidal soil. It is either slightly acidic or neutral chemically and not at all calcareous. It is generally not saline or alkaline.

5. Calcareous Chao Soil [3500 3390 0960]. This is a dryland soil that has developed out of Chang Jiang sediment containing night chao soil [1123 3390 0960], chao sandy soil [3390 3097 0960], putty soil, goutou sandy [3699 7333 3097] and running sandy soil [6410 3097 0960], and covers an area of about 4.68 million mu. It is calcareous, but its calcium carbonate content is fairly low. It is generally not saline or alkaline. Nutrients run from moderate to high; organic matter is about 1.5 to 1.8 percent; and total nitrogen is around 0.1 percent. This soil is friable, most of it being light to medium soil with night chao [1123 3390] characteristics. Goutou sandy topsoil contains bentonite.

6. Saline Tidal Soil. This is a dryland soil formed following reclamation of coastal saline soil, which contains desalineated soil, resalinated soil, and lightly saline soil. It covers an area of about 8.52 million mu, made up largely of desalinated soil, which accounts for more than 50 percent. Saline tidal soil's alkaline content is primarily in the form of sodium chloride. In derno podsolic soil, the sodium chloride content is less than 0.1 percent; in resalinated soil it is from 0.1 to 0.2 percent, and in lightly saline soil it is from 0.2 to 0.4 percent. Mineralization of ground water is fairly high, generally 1 to 4 grams per liter and as high as 10 to 20 grams per liter. It is chemically calcareous producing a mildly alkaline reaction. Organic content is from one to two percent.

7. Mucky Soil [0545 3364 0960]. This is a white clay type dryland soil found in the brown soil belt and consists of mountain sandy soil [1545 3097 0960], mucky soil, blue sandy stiff soil [7230 3097 2647 0960], white bentonite, and huangtutou [7806 0960 7333]. The mother material from which these soils have been formed is ancient flood sediment with sand on top and clay beneath. They are distributed on the gentle hills of the eastern part of the Xu-Huai region over an area of about 1.05 million mu. Classic mucky soil shows a characteristic layering in cross section, the layer beneath the top soil is of white clay with numerous ferro-manganese nodules, and further down is a layer of purple mud heavy in clay. Because the soil is sandy above and clayey below, it is prone to retain water and become mucky. Fertility is very low and organic content is less than one percent, generally 0.5 to 0.7 percent. The soil is lacking in nitrogen, phosphate and potash.

8. Stiff Yellow Soil [7806 0304 0960]. This is a common dryland soil found in limestone areas of brown soil regions. It includes mountain red soil [1472 4769 0960], mountain yellow soil [1472 7806 0960] and mountain silt as well as loess and baichang soil [4101 3358 0960] on hills. It covers an area of about 2.94 million mu of which 400,000 mu is made up of mountain red soil and mountain yellow soil. Mountain silt covers a 240,000 mu area; baichang soil 1.33 million mu area, and loess covers a 970,000 mu area. All these soils are chemically neutral. Soil quality is rather clayey; soil strata are thick, but the layer of mature soil is shallow, a hard clay pan underlaying the whole. Nutrient content is rather low, and these soils are prone to loss of water and fertility. When used in terraced fields, a substantial amount of work is required.

Huanggang Soil [7806 0474 0960]. This is a dryland soil of the Zhenyang hill region that has developed out of yellow-brown soil. It includes loess, and dead loess [2984 7806 0960], and covers a 950,000 mu area. It is slightly acidic chemically. Soil quality is rather clayey, and the cultivated layer varies in both thickness and fertility. In most places a clay pan underlays this soil. Its fertility is moderate, but loss of soil, loss of water, and loss of fertility are common.

10. Low marshland field soil [1000 3944 0960]. This is dryland soil formed from the deep uplifting of land in the lake and marsh region of the Lixia He. This land is in the shape of a laystack. It covers an area of about 20,000 mu in widely scattered bits and pieces. Its fertility is rather high, and it has good plowability.

3. Forestland and Wasteland Soils

The principal forestland soils are brown earths (including leached brown soil), yellow-brown soil, and yellow soil. Wasteland soils include these three plus bog soil and coastal saline soil.

1. Brown Earth. This is found largely in the low hills of Yuntaishan and Ganyu counties. It is generally slightly acidic and, except for the layer of topsoil, contains very low organic content. Leached brown soil is found in the hilly regin of Tongshan county. It reacts neutrally and slightly acidically. The surface layer is thin and infertile; soil quality is heavy, and organic matter has been rather well decomposed.

2. Yellow-Brown Soil. This soil is found in the hill and mountain region of Zhenyang and in the low hills on the Lake Tai Plain. It is acidic to slightly acidic. The Yellow-brown soil in mountain areas has been severely eroded, and the topsoil is rather infertile. On terraced hills, the yellow-brown soil is fairly thick. It is very clayey, and its natural fertility is not high.

3. Yellow Soil (Yellow and Red Soil). This is found mostly in the Yili Mountain region. It ranges from acidic to strongly acidic. It has a rather abundant organic content, but it has been strongly decomposed. This soil is also deficient in phosphate.

4. Bog Soil. Distributed here and there in lowlying lake marsh areas, this soil has high organic content, generally from 4 to 10 percent, total nitrogen ranging from 0.2 to 0.8 percent, and an abundance of mineral nutrients as well. However, drainage is bad; the soil is soft and mucky; and effective fertility is low. Once drainage conditions have been improved and this soil has been reclaimed for the growing of paddy rice, it becomes grass stubble [5430 3257] soil and baked soil.

5. Coastal Saline Soil. Found on the coastal plain and beaches where ground water mineralization amounts to from 10 to 20 grams per liter or 20 to 30 grams per liter, and the salinity of the soil is more than one percent. The salts are more than 80 percent sodium chloride.

3. Evaluation of Fertility of Cultivated Soils

Evaluation of the fertility of cultivated soils requires not only consideration of the kind of soil, but also the soil's environmental conditions and layer structure. Generally speaking high yield soils (farmland soils producing consistently high yields) are characterized by flat land, easy irrigation and drainage, a thick mature layer of soil, and no obstructions in the way of dense growth of crop roots. Also necessary is good soil porosity, abundant nutrients, and capacity to preserve and supply nutrients, etc. Low yield fields generally have pronounced factors causing the low yields such as coldness, dampness, and retention of water, salinity, alkalinity, sandiness, and infertility; strong clay qualities and stiffness, an infertile cultivated layer, etc. Soils that produce ordinary yields usually have no outstanding low yield factors, but fertility is not as great as in high yield fields. In evaluating fertility of

cultivated soils, it is necessary to consider the different requirements of wetland and dryland crops, making separate evaluations of dryland and wetland soils.

(1) Evaluation of Wetland Soil Fertility

The shanxue yellow agrilla, the yellow agrilla, the shanxue belozem, and the shanxue wushan soil of the Lake Tai region; the ridge mud [1096 3136] and the intercalated ridge and sand soils of the region along the Chang Jiang, the red sandy soil and the qin sandy soil of the Lixia region, and the xuesi magan soil, hongjin belozem, and black belozem of the Zhenyang hill region are all in the category of high yield soils (or are called high nitrate ground water paddy soils). They account for about 50 percent of the total paddyfield area, are most numerous in the Lake Tai region, secondly in the area along the Chang Jiang and the Lixia He, and scarcely at all in the Zhenyang hill region. The most representative characteristics of their cultivated layers are "eel blood" [shanxue 7668 5877], "red sinews" [4767 4585], and "capillaries" [5877 4828]. The common characteristics of these soils are as follows: (1) Good drainage conditions both outside and inside the soil, their being neither loss of water nor retention of water; level land surface, and ease of drainage and irrigation. (2) Good soil layer structure with a thick cultivated layer about 18 to 30 centimeters thick and an 8 centimeter thick plowpan underneath this, followed by a 30 to 40 centimeter thick speckled layer [2432 4773 1461], and a 50 centimeter thick area with no obstructions in it (such as a belozem layer, a blue mud layer, or a layer of ferrimorphic soil). (3) Neither too much sand nor too much clay; good plowability, a long season during which they may be plowed; and good porosity. (4) Abundant nutrients in the cultivated layer with an organic content of about two or three percent, and a total nitrogen content of from 0.15 to 0.18 percent. (5) Good nutrient preservation and supply capabilities, fertility remaining constant for a long period of time.

The wushan soil, blue-yellow mud and belozem of the Lake Tai region, the intercalated ridge and sand soil of the area along the Chang Jiang, the yellow clay soil, garlic clove soil, and the black clay soil of the Lixia He area, the Magan soil and pulverized soil of the Zhenyang hill region, and the saline silt of the coastal region are all ordinary yield soils, which account for about 30 percent of the total paddyfield area of the province. Fertility of these soils is moderate; plowability is ordinary, and they have no conspicuous faults.

Low yield rice paddy soils are of two kinds. (1) Infertile illuvial type, including the stiff belozem soil of the Zhenyang hill region, the illuvial belozem of the Lake Tai region, the illuvial sandy soil along the Chang Jiang, the pulverized jiang [3364] soil and some of the baijiao soil [4101 5183 0960] in the Lixia He area, and the saline sandy soil of the coastal area. These soils have a high pulverized sand or fine sand content; soil structure is poor; and they are prone to caking and stiffening. Their organic content is low, usually less than one percent, and their content of nitrate, phosphate, and potash nutrients is also relatively low. (2) Cold wet, clayey types. These include the yashi soil, the black baked soil, and the baked soil of the Lixia He, the grass stubble soil, the blue mud soil, and the shutou wushan soil

of the Xiali He area, and the blue mud stripes of the Yangzhen hill region. Largely because of poor drainage, soil quality is heavy and sodden and porosity poor. Despite high organic content, the latent fertility cannot be readily used. Plowability is also rather poor. Low yield paddy soils of these two types account for about 20 percent of the province's total old rice paddy area, mostly in the Zhenyang hill region, the Lixia He area and the area along the Chang Jiang cominb next, and the Lake Tai area having least.

(2) Evaluation of Dryland Soil Fertility

The two combined soils, the honghua silt and the silt of the Huang He flood plain, the aged soil and most of the aged yellow soil, the black lacustrine soil, and a portion of the black hill soil (erhe black soil) of the Yi and Shu river plain, the derno podsolic intercalated sandy soil and most of the derno podsolic silt of the coastal area, the putty soil, and a portion of the highly sandy soil of the area along the Chang Jiang, and a portion of the mountain silt of the hill and mountain region are in the category of high yield dryland soils, accounting for about 20 percent of the province's dryland area. Of these soils, the two combined soils and the derno podsolic intercalated sandy soil are most representative; fields are level, and drainage and irrigation can be done smoothly. Their mature soil layer is thick, and there is an unobstructed layer of more than 70 centimeters in thickness (such as a shajong layer, a firm sand layer, or a white bentonite layer). Sand and clay are about equally balanced and porosity is good. Preservation of soil moisture is good, and the soils are not prone to clogging. Plowability is good, and the area when plowing can be done long. Nutrient content is fairly abundant, and effective fertility is high.

The blue sandy soil, the sandy soil, and the aerating silt [3345 7364 3226] of the Huang He flood plain, the yellow sandy soil, the lacustrine black soil, and most of the black hill soil of the Yi and Shu river plain, the desalinated soil and some of the desalinated silt of the coastal area, the tidal sandy soil of the area along the Chang Jiang, and the blue sandy stiff soil, the mountain red soil, the mountain yellow soil, the hill yellow soil, the hill soil and most of the mountain silt of the hilly and mountainous region are soils that produce ordinary yields and account for about 50 percent of the province's total dryland area. Soil fertility is moderate, and the soils have no pronounced deficiencies.

There are four kinds of low yield dryland soils as follows: (1) Alkaline-saline type including the mottled alkaline soil of the Huang He flood plain, and the resalinated soil, lightly salinated soil, and heavily salinated soil of the coastal plain. The most common reason for low yields is damage caused by salinity and alkalinity; additionally, soil quality tends to be sandy and rather infertile. (2) Sandy infertile type including the blown sand soil, the soaked sand soil and some of the sandy soil of the Xu-Huai region, and the goutou sand and running sand soil of the area along the Chang Jiang. The most common reason for low yields from these soils is their overly sandy nature and low nutritional content. Sand particle content reaches as much as 50 to 80 percent, and organic content is less than 0.5 percent or even lower. (3) The mucky sandy type soils of low fertility. These are the mucky soils (not

including the blue sand stiff soil) of the Xu-Huai area. The main reason for their low yields are water retention and muckiness, plus overly sandy topsoil and low nutrient content. (4) Heavy dry and waterlogged type. These include the lacustrine black soil and some of the black hill soil of the Xu-Huai region. The main reason for their low yields is heaviness, low fertility, and poor plowability. They account for between 20 and 30 percent of the province's total dryland area.

Fifth Section. Soil Resources

Jiangsu Province land area totals 102.6 million square kilometers. The proportion of the land used for agricultural purposes is fairly large, amounting to more than 60 percent of the total area. The ratio of people to land is fairly low averaging only 2 mu per capita of agricultural population, or only 1.4 mu of cultivated land. Inland freshwater surfaces are very extensive averaging more than 0.5 mu per capita of agricultural population. In addition, shallow marine areas are vast and beach resources very abundant.

1. Status of Utilization of Soil Resources

The province's land resources are used primarily for farming, livestock raising, planting, and fishing areas being rather large, land used for forestry and animal husbandry being small by comparison. Land currently used for agriculture totals more than 81.32 million mu, which is 54 percent of the total land area or 45.8 percent of the cultivated land area. Forestlands account for 3.3 percent, and freshwater hatching and growing area accounts for 4.8 percent. If the agricultural land that could be used is added to this, the total amount of land used for agriculture would become more than 60 percent, of which the amount of cultivated land would increase to 48 percent, the amount of water surfaces used for hatching and growing would increase to 7.8 percent, and the area used for forestlands would increase to more than 4.5 percent. Population density of the province is heavy. In 1976 there was an average 557 people per square kilometer. Industry, mining, communications, and transportation are fairly well developed; consequently, the proportion of land used for non-agricultural purposes such as for urban and rural dwellings, roads, factories, and mining enterprises is fairly large, amounting to about 30 percent of the total. Additionally, freshwater surfaces not suitable for hatching or raising of aquatic products, but which provide fishing, amount to nine percent.

Table 1-3 Utilization of Province's Land Resources

Kind of Land	Land Area (10,000Mu)	As a Percent of Total Land Area *
Total Area	15,390.00	100.00
1. Agricultural Land in Use	8,132.15	54.01
Including (1) Cultivated Land	7,058.29	45.86
(2) Forestland	516.55	3.34
(3) Freshwater hatching	437.31	2.86
(4) Freshwater farming	300.00	1.95
2. Land Useable for Agriculture	944.26	6.15
Including (1) Suitable for farming	300.00	1.95
(2) Suitable for forestry	181.57	1.19
(3) Hatching & farming water surface	462.69	3.01
3. Other	6,133.59	39.84
Other freshwater surfaces (Mostly for fishing)	1,400.00	9.15
Other non-agricultural land (Including land for urban and rural home sites, roads, factories, and mining enterprises.	4,733.59	30.69

*During the period immediately following Liberation in 1949, cultivated land in the province totaled somewhat more than 82.85 million mu. In 1975 statistical figures for cultivated land showed somewhat more than 70.58 million mu, but it is believed that the amount of cultivated land could not have declined by this much. Therefore, the actual proportion of land used for non-agricultural purposes is less than 30.69 percent.

(1) Cultivated Land

In 1976, cultivated land in the province totaled 70.34 million mu. Following Liberation, despite a gradual decline in the cultivated area, a gradual and steady increase took place in the multiple cropping index till it became quite large. In 1957, the multiple cropping index for the province was 162 percent; by 1962, it had risen to 171 percent; by 1971, it increased further to 187 percent; and by 1976, it reached 202.6 percent. In a period of 19 years, it increased by a total of almost 40 percent.

Cultivated land use is of two types, for the most part, wetlands and drylands. In 1976, wetlands totaled 42.47 million mu, or more than 60 percent of the total cultivated land area. The three areas of Lake Tai, the Lixia He, and the Zhenyang hill region have traditionally been the province's old rice growing areas, and it is here that paddy fields are most concentrated. Currently, they are estimated to amount to 55 percent of the province's total ricefield area. The highly sandy areas of the Xu-Huai region and along the Chang Jiang have always been predominantly drylands, but in recent years great efforts have been put into turning drylands into wetlands, so the wetlands area is steadily expanding. The paddy rice area in the Xu-Huai region has

expanded to almost 8 million mu, accounting for more than 30 percent of the region's total cultivated land area, and amounting to almost 20 percent of the total wetlands area of the province. Drylands in the province total 27.97 million mu, or almost 40 percent of the cultivated land, a great decline since 1965 (when it was 58 percent). These drylands are still concentrated in the highly sandy Xu-Huai region, along the seacoast and along the Chang Jiang south of the Huai, each area amounting to 17 million mu, 6 million mu, and 2.8 million mu respectively, or about 60 percent, 20 percent, and 10 percent respectively of the drylands area of the province. The second area of concentration is in the Zhenyang hill region where drylands are seen only atop hills and on some high slopes, covering an area of about 1.3 million mu. In the Lake Tai and Lixia He regions, drylands are rare, totaling less than 1 million mu.

(2) Forestlands

In 1975, forestlands in the province totaled 5.16 million mu, or 3.4 percent of the total land area, a very low cover rate. This forestland was devoted mostly to timber forests, economic forests being second in importance. These forests covered an area of 2.38 million and somewhat more than 1.56 million mu, or 46.5 percent and 30.6 percent respectively of total forest area. There was, in addition, somewhat more than 550,000 mu of bamboo forests, accounting for 10.8 percent, and somewhat more than 360,000 mu of shelter forests amounting to 7.2 percent. Continuous stretches of timber forests were concentrated largely in low hill and mountain areas, accounting for about one-half the total timber forest area. The remaining half was spread out everywhere in the province. Farmland and fruit orchard shelter forests were concentrated largely in regions north of the Huai and along the seacoast, which are relatively dry and cold, and fairly seriously troubled with windblown sand. Such areas account for 43 percent and 55 percent respectively of shelter forest lands.

Economic forests are devoted principally to mulberry trees, which cover more than 730,000 mu or 46.3 percent of the total economic forest area. Distribution of mulberry groves is fairly widespread, principally in the Lake Tai and Ningzhen hilly region where they account for 55 percent of the total economic forestland. Second in importance is the stretch along the Chang Jiang south of Tongyang, which accounts for almost 30 percent. Land used for forest groves is mostly odd plots along rivers or roads, or some small rises in the middle of fields. There are very few continuous tracts of mulberry trees. Mulberry grove growth has been fairly rapid between the Chang Jiang and the Huai, and north of the Huai where mostly banks on both sides of the rivers have been turned into bases. In addition, the farflung communes and production brigades have also gone in for small mulberry groves. The province's fruit orchards cover 590,000 mu, accounting for 37.5 percent of economic forestlands. The area in which continuous tracts of orchards are concentrated is north of the Huai in the old bed of the Huang He, and in the low hill region that surrounds Lake Tai south of the Chang Jiang. Fruit orchards in the old bed of the Huang He make full use of the sandy soil there, growing on 200,000 mu, or more than 30 percent of the province's fruit orchard land. The low hill region around Lake Tai is Jiangsu Province's only fruit growing area that

remains permanently green. Other fruit and nut growing orchards are dotted everywhere throughout the province. The tea grove area totals 150,000 mu, and is pretty well concentrated on the terraced land in the foothills of Maoshan, in the small basins between the mountains of the Yili mountain region, and on the gently slopes of the Ningzhen hills. These areas account for 85 percent of the tea groves in the province. In Xuchi and in the Yi, Liu, Fulhills, as well as on the slopes and in the foothills of the low hills along the Chang Jiang, another 15,000 mu of tea groves are farmed.

Table 1-4. Utilization of Forestland in Jiangsu Province (1974)

Kind of Forestland	Area (Mu)	As a Percent of Total Forestland
Total	5,129,399*	100.0
1. Timber Forest	2,387,448	46.5
2. Shelter Forest	367,829	7.2
3. Economic Forest	1,569,822	30.6
(1) Including: Tea	147,841	2.9
(2) Mulberry	737,196	14.4
(3) Fruit	589,806	11.5
4. Bamboo	557,877	10.8
Including: Mao bamboo	259,037	5.0
5. Firewood Forest	213,250	4.2
6. Special Purpose Forest	33,053	0.7

* Plus the 1975 afforested land to make a forestland total of 5.16 million mu.

The area of the province currently dedicated to forests is proportionally small. In addition, some low mountains and hills have been blindly cleared for agriculture, the forests destroyed in order to grow grain. This not only hurts the maintenance of the soil against erosion and the development of forestry, but also hurts development of agriculture. Numerous mulberry groves and fruit orchards that once dotted farmlands south of the Chang Jiang were pulled up and no planning done for them in the process of the capital construction of farmlands or leveling of the land. Furthermore, north of the Huai some of the collectively owned fruit orchards are senselessly intercropped with grain to the detriment of fruit tree output. These problems require satisfactory solution.

3. (3) Pasturelands

The province's pastureland area is very small and is scattered on odd bits of land. Formerly some marine beaches, lake shores, sandbanks, and wastelands were used year round or seasonally as pasture grounds, places like the grassland area between the Lixia He and west of the Grand Canal, stretches of grassy flats inside and outside the seawall in coastal regions, on rush flats on sandbanks along the Chang Jiang, and on some unreclaimed grasslands in hilly areas. But many of these pasturelands were also suitable for farming or forestry, and in recent years lakeshores and sea beaches have been reclaimed, and waste

mountains and wastelands have been brought under cultivation. The trend has been toward a gradual contraction of pasturelands to the detriment of development of the livestock industry. Planning that takes all factors into account is required.

(4) Freshwater Water Surfaces

Jiangsu freshwater water surfaces total more than 26.04 million mu and take up 16.9 percent of the total land area, which is fairly large proportion. Nevertheless, raising and planting in this area is currently by no means large. In 1975, the freshwater area for raising aquatics was 4,373,100 mu, and the planting area was 3 million mu, the two totaling 28 percent of total water surface area and only 36.4 percent of the 12 million mu water surface area capable of supporting aquaculture.

Currently the aquaculture area is mostly streams over an area totaling 2.24 million mu. Generally the volume of water in streams is fairly great and the current does not flow very fast. Watercourses that are wide and shallow favor raising. The pond raising area takes second place. This is mostly located around rural towns, and in fields or alongside roads where the water has a lot of nutrients, where investment required is small, and where care is convenient, making for intensive raising and a potential that is very large. Jiangsu Province has a goodly number of large and medium size lakes with large water surfaces in which breeding and care of aquatic products is not easy, and which are used principally for catching fish. The raising area already amounts to 63 percent of the area suitable for aquaculture. Reservoirs are concentrated in hill and mountain areas where the area used for raising is now 67 percent of the ara suitable for aquaculture, so there is unused potential. In addition, the province's vast water surfaces and their extensive area are generally good for fishing. For example, in the Chang Jiang, the water surface is broad, the volume of water great, and water resources abundant; this is a major base for freshwater fishing.

Table 1-5. Utilization for Aquaculture Raising of All Kinds of Water Surfaces in Province (1975)

1) 水面类型	淡水面积 2)（万亩）	可养殖面积 3)（万亩）	占淡水面积 4) %	1975年已养面积 5)（万亩）	占可养面积 6) %	占已养总面积 7) %	可养未养面积 8)（万亩）	占可养面积 9)（万亩）
10) 总计	2604.6	500.0	21.1	437.31	79.4	100.0	122.69	20.6
11) 湖泊	1452.0	100.0	6.9	63.00	63.0	14.4	7.00	7.0
12) 河沟	911.9	256.0	28.0	224.10	87.5	51.3	31.90	12.5
13) 水库	71.9	60.6	84.2	40.85	67.4	9.3	19.75	32.6
14) 池塘	168.8	133.4	79.0	109.36	81.9	25.0	24.04	18.1

1. Kind of water surface
2. Freshwater area (10,000 mu)
3. Possible raising area (10,000 mu)
4. Percent of freshwater area
5. 1975 area used for raising (10,000 mu)
6. Percent of possible raising area
7. Percent of area used for raising
8. Possible raising area not being used (10,000 mu)
9. Percent of possible raising area
10. Grand total
11. Lakes
12. Rivers and ditches
13. Reservoirs
14. Ponds

(5) Shallow Ocean Waters and Beaches

Jiangsu has a 1,037.7 kilometer long coastline. In shore fishing grounds cover 154,000 square kilometers (the western side of the South China Sea and the Yellow Sea on the continental shelf within a depth of 100 meters), of which the operating area is about 90,000 square kilometers (the four large fishing grounds of Haizhou Bay, Lusi, Dasha, and the mouth of the Chang Jiang). Beach areas cover 4.93 million mu, including more than 5 million mu of seaports, 31 percent of which is high tide area, 52 percent of which is medium tide area, and 17 percent of which is low tide area. These are major beach raising bases. The seacoast has a fairly large number of salt water farms, saltworks, streams, water discharge ditches, river ports, sea walls, and low-lying ponds fed by streams over an area of 180,000 mu, 130,000 mu of which can be supplied for the raising of aquatic products and are major semi-salt water raising areas. At the present time, utilization of ocean beaches and utilization of in shore areas for fishing is far from complete. In 1975, the province's total marine raising area was only 13,400 mu. Except for the fairly good foundation that exists for the raising of kelp in the shallow sea, output of other products, most notably the taking of mollusks, is slight. Raising of aquatic products on beaches and in ports is next to nothing. The in-shore fishing industry has long been established, but per unit yields are low. Catches by ocean-going ships, for example, amount to only 1.15 tons per horsepower. For motorized junks, catches are 1.04 tons per horsepower, and for junks they are only 2,500 jin per ton.

2. Potential for Further Development of Soil Resources

A considerable potential exists in this province for further, full, and sensible use of wasteland resources, water area resources, and farmland already in use.

(1) Sensible Reclamation of Wasteland to Improve the Cultivated Land Utilization Rate

This is a province with large population relative to cultivated land in which wasteland should be sensibly reclaimed, in which efforts should be made so that there will be no further decline in available land but rather an expansion, and in which vigorous efforts should be made, at the same time, to increase the cultivated land utilization rate.

At the moment reliable figures are still lacking about the amount of land in the province that is suitable for reclamation. Considerable tracts of wasteland suitable for reclamation do exist, concentrated principally along the seacoast, where they total an estimated 2 million to 2.5 million mu. There is not a large amount of such wasteland inland. According to incomplete data, within state farms in coastal areas, more than 100,000 mu of wasteland still awaits use. North of the Huai in Ganyu country, within the seawall near Hongkou, there is also 100,000 mu of wasteland that can be put to use. According to calculations made at the end of 1975, south of the main irrigation canal between the first seawall and the low tide line lies 3.41 million mu of beach land of which it has been figured that more than 810,000 mu above the shoreline is virtually unaffected by ocean tides. Were this reclaimed up

to the average high tide line, it would total 1.7 million mu. Considered in terms of future longterm development of agricultural production for the province, and in terms of the beaches coming into their own, the focus of reclamation should be in Dongtai, Dafeng, and Sheyang counties in Yancheng Prefecture. However, over the short run, in the reclamation sites in coastal areas, full use must first be made of wasteland resources within the seawall. At the present time, quite a bit of low-lying land within the seawall has not been reclaimed for use. In Yancheng Prefecture alone there is between 200,000 and 300,000 mu (not including state farms). In making use of reclaimed coastal land, consideration must be given overall development, farming being paramount. Unified planning has to be done for forestry and animal husbandry utilization as well, equitable arrangements being made.

Lake marshes and lake shores suitable for reclamation are located mostly around lakes in Huaiyin, Yangzhou, Yancheng, and Zhenjiang prefectures, most of them scattered here and there. Fairly large areas suitable for such reclamation are concentrated around Gaobao Lake and Hongze Lake, and use of these kind of lakeshores must also be planned in an all around way, with full consideration given the storage of flood waters, and the multifarous needs of aquatic plants, reedlands, and pasture grasses.

Inland plains wastelands, most notably sandy wastelands on both banks of large rivers in the Xu-Huai area, have been opened over fairly large areas to fruit orchards and forest belts. Now there are still more than 100,000 mu of low-lying land on the river flats of the old bed of the Huang He (above Yangzhuang) for which reclamation is underway as part of a plan for the comprehensive use of the old bed of the Huang He. In Suqian County, 52.7 kilometers, and in Siyang County 62.9 kilometers of the old bed of the Huang He are being planned for comprehensive control and reclamation to make fields. This can create more than 30,000 mu and more than 40,000 mu respectively of newly reclaimed agricultural land and will, at the same time, open up a certain area of ponds for the raising of fish.

In addition to suitably increasing the multiple cropping area, a substantial potential still exists for making full use of existing cultivated land through leveling of fields, preparing the land, and improving rural residential sites. Inasmuch as individual areas differ, the kind of leveling of fields and preparing of the land that is done differs, and the land improvement rate also differs. In recent years, some places have increased cultivated land area by from two to three percent solely through promotion of the covering of ditches. At an average two to three percent rate of increase throughout the province through the leveling of fields and preparation of the land, an increase in cultivated land of between 1.3 million and 2 million mu could be realized. A similar situation exists in reform of rural residential sites. South of the Chang Jiang, population is large relative to cultivated land. At old residential sites, each household generally occupies a relatively small amount of land, but when all the roads and unused spaces in villages are included, each household averages more than 100 square meters of land. In the area between the Chang Jiang and the Huai, and in the western part of the province, the amount is slightly more, an average of about 150 square meters. North of the Huai it is even more, probably somewhat more than 200 meters. Along the

seacoast it is greatest at an average of more than 300 square meters. Experience everywhere has shown that new residential sites occupy 100 square meters of land at most (including use of land for collective structures). Accordingly, were rural residential sites throughout the province to be reformed, an increase by at least somewhat more than 1.5 million mu of land could be realized. From the two aforementioned measures, between 2.8 million and 3.5 million mu of land could be added.

Table 1-6. Kinds of Wastelands in Province Suitable for Forests and Regional Distribution (1974)

1) 宜林地类型	合计 2)(亩)	徐州地区 3)	淮阴地区 4)	盐城地区 5)	扬州地区 6)	南通地区 7)	镇江地区 8)	苏州地区 9)	南京市 10)	其他省辖市和农垦局所属单位 11)
12) 合计	1,815,780	308,000	498,232	147,279	52,680	45,143	398,351	60,217	237,836	68,042
13) 荒山	993,466	176,606	243,952	—	18,070	—	339,968	41,135	158,725	15,010
14) 荒地	802,774	112,343	254,025	147,279	34,610	45,041	58,368	19,082	78,994	53,032
15) 沙荒	19,540	19,051	255	—	—	102	15	—	117	—

1. Type land suitable for forests
2. Total (Mu)
3. Xuzhou Prefecture
4. Huaiyin Prefecture
5. Yancheng Prefecture
6. Yangzhou Prefecture
7. Nontong Prefecture
8. Zhenjiang Prefecture
9. Suzhou Prefecture
10. Nanjing
11. Other municipalities subordinate to the province and units subordinate to the State Farm and Land Reclamation Bureau
12. Total
13. Barren mountains
14. Wastelands
15. Sandy wastelands

(2) Vigorous Expansion in Use of Land for Forestry, and Increase in Forest Cover Rate

1. Full use of the "three wastelands" suitable for forests. A forestry survey done in 1974 shows a total of more than 1.8 million mu of "three wastelands" suitable for forests. Of the "three wastelands," the barren mountain area suitable for forests is greatest, amounting to 1 million mu or almost 60 percent of the total. This area is located mostly in Ningzhen, Maoshan, Yilin, and the Laoshan regions, and is suitable for development of timber forests and semi-tropical economic forests. A second area is in the mountains of Yuntai in the northeast, in the Xuchi hills in the west, and in the hill and low mountain area of the northwest. This area is suited to development of timber forests and a small quantity of economic forests. The remaining area is located mostly in Yizheng in Yangzhou Prefecture, and in the low hills around Lake Tai in Suzhou Prefecture, where mostly economic forests may be grown. Wastelands suitable for forests and totaling more than 800,000 mu are located mostly in the old bed of the Huang He and both banks of other rivers

in the Xu-Huai area, as well as along the sea in Yancheng Prefecture. These areas are suitable for growing mostly shelter forests and timber forests. The sandy wasteland area suitable for forests is very slight and located in the western part of Xuzhou Prefecture.

2. Major efforts in the greening and afforestation of the "four besides" [beside streams, roads, villages, and houses]. Residential areas and transportation networks in the cities and countryside of Jiangsu Province are dense; water surfaces are extensive; waterways are close together, and the area of lake and river embankments is large. In the course of farmland capital construction centering on control of water and improvement of land, waterways, ditches, fields, forests, and roads, all forming part of a whole, a very great potential exists for making full use of vacant land in the "four besides" for afforestation. For example, figuring an average per capita 150 trees planted in rural areas and each 500 trees amounting to a mu of forest, that would mean a total of 7.5 billion trees or a total of 15 million mu of forestland. When afforestation of low mountains, hills, cities and towns is added to this, it is calculated that the province's forest cover rate would be increased to about 15 percent.

(3) Sensible Planning For Pasturelands and the Building of Livestock Industry Bases

Sensible planning for use of grassy flatlands, sea beaches, barren mountains, and wastelands for the building of livestock industry bases is a major aspect of this province's rational use of land resources. Along the seacoast and in the lake area between the Lixia River and west of the Grand Canal, there is a large area of fine sea beaches and grassy flatlands that, if planned in a unified way with arrangements for all around use being made, could be used partially for rotational grazing to establish a large base for draft animal and beef cattle production. The wasteland area along the seacoast that is useable by state farms is considerable, and consideration can be given to a combination of farming and livestock raising, with the establishment of some livestock farms. Additionally, in the hill region of Zhenyang and in the Xu-Huai area, which are places that have formerly had some experience in the breeding of draft animals, bases for the breeding of cattle for use both as draft animals and for meat may be established.

(4) Full Use of Freshwater Surfaces

Jiangsu Province still has a very great potential for use of its freshwater surfaces. In recent years, freshwater raising of aquatic products has developed rather rapidly; however, about 20 percent of water surfaces that might be used to raise aquatic products remains unused. Aquaculture can be done on most of the medium and small size inland water surfaces of the province, and serious attention should be given increased production in the high potential Lake Tai basin, and in the Lixia He region where production conditions are rather good. At the same time, serious attention should be directed to development of the aquaculture industry in reservoirs. In reservoirs, living conditions for fish are good, and they grow rapidly there. Yields per unit of area for raising of fish over large areas in reservoirs are no less than from ponds, and they may

be built into one of the kinds of aquaculture bases. Freshwater surfaces that the province can provide for farming amount to about 6.5 million mu, only 3 million mu of which are currently being used. In the extensive area between the Lixia He and to the west of the Grand Canal and in the marshlands to the east of the Grand Canal, in the ponds around Lake Tai in Suzhou and Wuxi, and in gullies and ponds in low-lying coastal areas, farming in water surfaces is rather well advanced, but a great potential still remains to be tapped. In places in which the farming of water surfaces has been slight in the past, conditions also exist for certain development. One such place is the Xu-Huai area which in recent years has developed the growing of a considerable amount of shallow water lotus root. The more than 20 million mu of large inland water areas in the province constitute freshwater fishing bases with great potential. While giving attention to breeding for the protection of resources, vigorous efforts should be made to increase per unit of area yields.

(5) Full Use of Shallow Ocean Waters and Beach Resources

Jiangsu Province has a great potential in its shallow ocean waters and sea beaches. Future development must be done on the basis of the condition of these resources with adaptation of general methods to local situations in planned establishment of shallow ocean aquafarms, gathering of catches along beaches, and operation of semi-saline water aquaculture production bases. At the same time, vigorous efforts should be devoted to tapping the production potential of in-shore fishing areas, to strengthening to the breeding and protection of resources, sensible provisions for old fishing grounds, active development of new fishing grounds, improvement in fishing techniques, and improvement in the system for gradual building of marine fishing industry production bases.

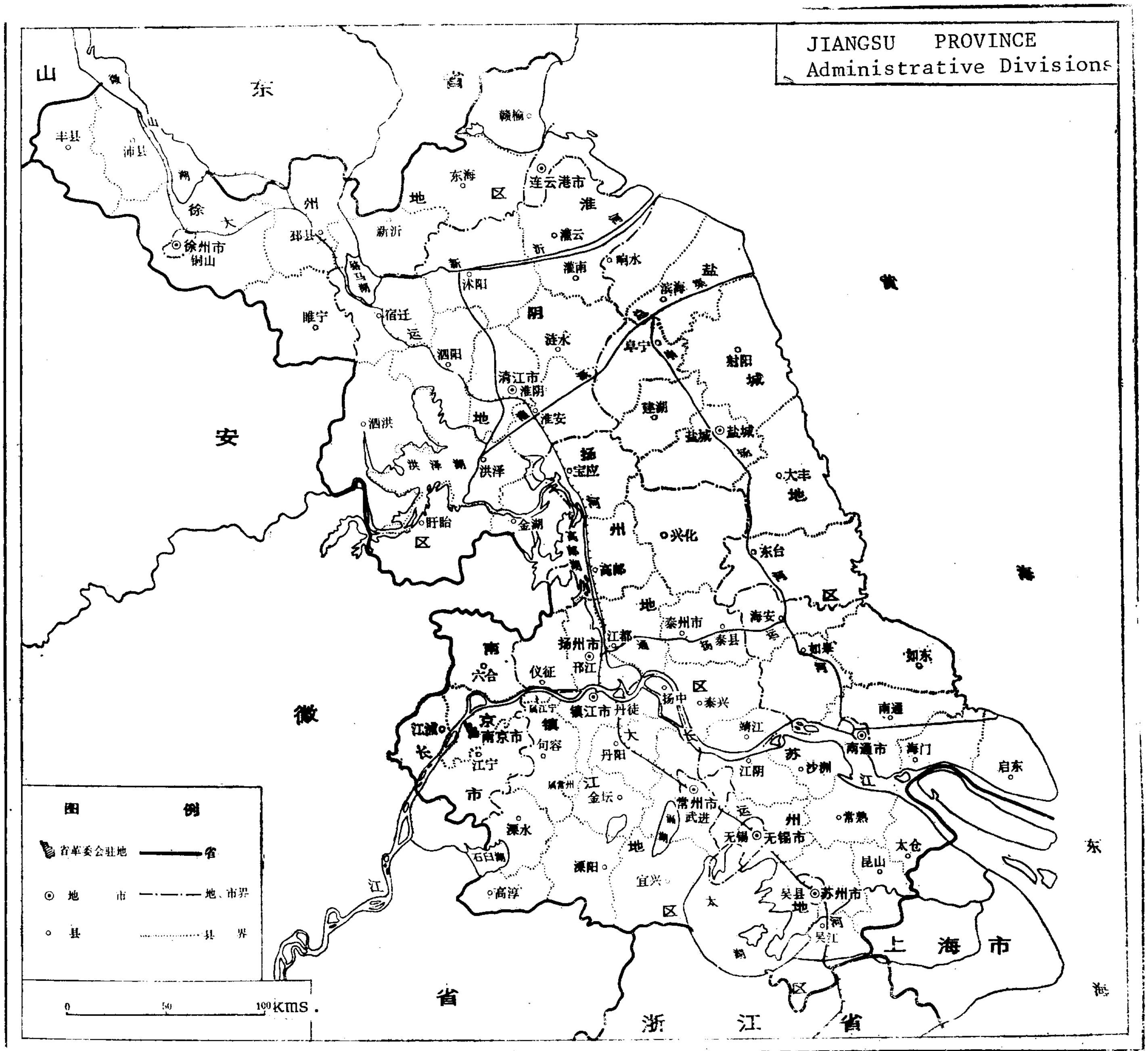


Figure 1

Legend

1. Location of Provincial Revolutionary Committee ——————— Province [Boundary]
2. ⊙ Prefectures and Municipalities -.-.-.-.-.-.- Prefecture and Municipal Boundary
3. ° County .... County Boundary

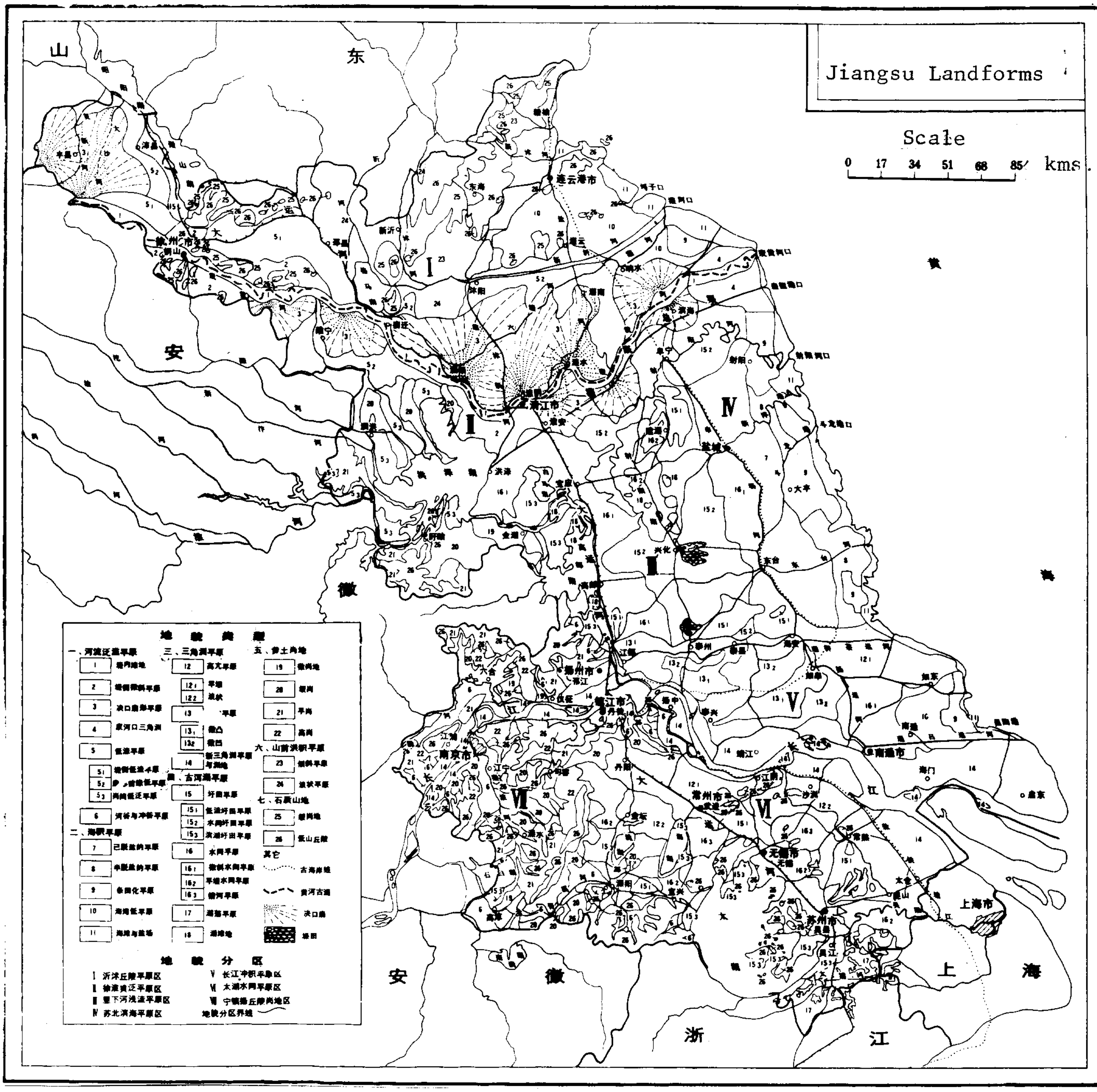


Figure 2

Types of Landforms

A. Flood Plains
1. Flat Land Within Dikes
2. Slightly Inclined Plain Beside Dikes
3. Burst Dike Fan-Shaped Plain
4. Delta at Mouth of Abandoned River

5. Lowlying Plain

5_1 Lowlying Plain Beside Dike

5_2 Low Plain at Edge of Fan Shape

5_3 Low Flood Plain Among Hillocks

6. River Valleys and Alluvial Plains

B. Marine Deposit Plains

7. Desalinated Plain
8. Semi-desalinated Plain
9. Strip Field Plain
10. Low Bay Plain
11. Ocean Beach and Saltworks

C. Delta Plains

12. High Plain

12_1 Flat Plain

12_2 Rolling Plain

13. [Illegible] Plain

13_1 Slightly Convex

13_2 Slightly Concave

14. New Delta Plains and Sandbars

D. Old Lagoon Plains

15. Diked Field Plain

15_1 Lowlying Diked Field Plain

15_2 River Network Diked Field Plain

15_3 Lakeshore Diked Field Plain

16. River Network Plain

16_1 Slightly Inclined River Network Plain

16_2 Flat River Network Plain

16_3 Trough River Plain

17. Marshy Plain
18. Lakeshore Land

E. Loess Downlands

19. Slight Mounds
20. Gentle Mounds
21. Flat Mounds
22. High Mounds

F. Overwashed Plain Below Mountain

23. Inclined Plain
24. Sloped Plain

G. Rocky Mountainland

25. Gently Sloping Hillocks
26. Low Mountains and Hills

H. Other

27. Old Coastline
28. Old Bed of the Huang He
29. Fan at Breached Dike
30. Walled Field

J. Landform Areas

I. Yi and Mu River Hilly Plain
II. Flood Plain of the Xu, the Huai, and the Huang
III. Lixia He Lowlying Plains Area
IV. North Jiangsu Coastal Plain Area
V. Chang Jiang Alluvial Plain Area
VI. Tai Lake River Network Plain Area
VII. Land Demarcation Line Between the Nanjing, Zhenjiang, and Yangzhou Hill and Hillock Areas

CSO: 4007/157

CHAPTER 2. MAJOR ACHIEVEMENTS SINCE THE FOUNDING OF THE CHINESE PEOPLE'S REPUBLIC IN WATER CONSERVANCY CONSTRUCTION, SOIL IMPROVEMENT AND REFORM OF THE FARMING SYSTEM

Nanjing JIANGSU NONGYE DILI [AGRICULTURAL GEOGRAPHY OF JIANGSU] in Chinese Jun 79 pp 41-55

[Text] Since the founding of the Chinese People's Republic, under the guidance of Chairman Mao's revolutionary line, Jiangsu Province has devoted major efforts to the capital construction of farmlands centering on water control and soil improvement. It has set off surging mass movements that have steadily gained new victories, and the mountains and rivers of the province are undergoing rapid changes. While vigorously improving natural conditions, everywhere there has been an adaptation of general methods to local situations in active reform of farming systems to make fuller use of natural resources and to promote all out efforts in agricultural production, which have won major achievements.

First Section. Large Scale Water Conservancy Construction

In old China, extensive areas of the province suffered serious harm from natural disasters in the form of floods, waterlogging, drought, and stagnation of flood waters. According to incomplete statistics, between 1074 and 1949, 303 large and small floods took place along the lower reaches of the Yi, Shu and Si rivers. One of these occurred in 1194 when the Huang He captured the bed of the Si He, and for more than 600 years thereafter, serious flooding occurred on an average of once every 2 years. After the Huang He changed to a northward course, a fairly large flood occurred on an average of once every 5 years. During the past 500-odd years, a major drought has occurred on an average of once every 5 years too. During the period when the Huang He took over the bed of the Huai, the lower reaches of the Huai had a fairly severe flood on an average of once every 2 years, and a fairly major drought on the average of once every 3-odd years. After the Huang He changed to a northward course, a fairly large flood took place on an average of once every 3 years, and a drought occurred on an average of once every 6-odd years. Even in the Lake Tai region, which is famed as a "land of fish and rice," natural disasters large and small also occurred from time to time. From the advent of the Qing Dynasty through the period of reactionary rule by the Kuomintang, fairly serious flooding occurred on an average of once every 18 years, and a fairly serious drought on an average of once every 51 years. Flood and drought disasters alternated with each other or occurred simultaneously in different

areas, causing extremely severe losses in agricultural production and in the lives and property of the people.

Following Liberation, the broad masses of cadres and people in Jiangsu Province took to heart Chairman Mao's teaching that "water conservancy is the lifeblood of agriculture," and "the Huai He must be brought under control," and bent major efforts toward the building of water conservancy to control flooding, waterlogging, drought, and stagnation of floodwaters. As a result of 26 years of arduous efforts, the province has either dredged or newly opened more than 30,000 kilometers of principal watercourses for the diversion or drainage of water. It has refurbished or built new river, sea, and lake embankments stretching more than 13,000 kilometers; has built more than 1,100 reservoirs; has reconditioned 370,000 pond dams, has built more than 23,000 fixed machine pumping stations for drainage and irrigation, and has constructed numerous large and small water recycling stations and pump wells, reconditioned terraced fields, dammed ravines, planted more than 6.4 million mu of forests to prevent soil erosion, and built more than 4,000 kilometers of underground ditches, etc. As of the end of 1975, it had moved an accumulated 13.6 billion cubic meters of soil and rock as part of initial comprehensive control over floods, waterlogging, droughts, and water stagnation, comprehensive use of water conservancy, water transportation, and aquatic products, a water conservancy network combining large, medium and small size facilities, and a new water system. Development of water conservancy construction has vastly improved capabilities to withstand disasters such as flooding, waterlogging, droughts, and water stagnation. Flood prevention capabilities have been increased against the Chang Jiang, the Huai, the Yi, the Shu, and the Si rivers. Draining away of floodwaters of the Huai, the Yi, the Shu, and the Si rivers has been increased from the 8,000 cubic meters per second of the period immediately following Liberation to 22,000 cubic meters per second. As a result of control, waterlogging has been eliminated on an area of more than 36 million of the province's more than 43 million mu that had been prone to waterlogging. Farmlands able to withstand daily rainfall of more than 20 millimeters total 23 million mu, and those able to withstand between 150 and 200 millimeters of rainfall total more than 30 million mu. On more than 22 million mu of land it is possible to control the underground water table at more than 1 meter below the surface, and on 34 million mu, it is possible to control it at between 0.5 and 1 meter. Reservoir water storage capacity in the province totals 18.2 billion cubic meters, and the irrigated area has increased from somewhat more than 27 million mu during the perid immediately following Liberation to 55 million mu, the free—flowing irrigated area of which amounts to more than 8 million mu, the area over which irrigation can be assured for 100 days without precipitation amounting to more than 32 million mu, and the area that can withstand drought for more than 70 days amounting to more than 10 million mu. More than 36 million mu of farmland that can produce harvests despite drought or waterlogging, producing consistently high yields has been built. This amounts to 51 percent of the cultivated land in the province.

The province's water conservancy construction has gone through four general stages, each of which has had its own focus for control: The immediate period following Liberation was when dikes were repaired and outlets opened forcing floodwaters to return to their proper channels with no further backing up of

sea water. The high tide of the agricultural cooperatives went along with control of flooding, principal waterways were dredged and locks built in ports in vigorous efforts on projects to get rid of waterlogging and effectively reduce flood and waterlogging disasters. The people's commune period was when planning and construction of a waterway network was given great attention, and projects began for the northward diversion of the waters of the Huai and the Chang Jiang, and the layout of a master river network for the entire province began to take shape. Concurrently, broad development of capital construction of medium and small farmland water conservancy projects was done for advances in breadth and in depth to lay a foundation for wide area reform of the farming system. Since the Great Proletarian Cultural Revolution, emphasis has gone to the continued building and equipping of water conservancy projects and the expansion of project benefits, as well as to farmland capital construction focusing on water control and soil improvement, with all around planning, comprehensive control, comprehensive utilization, high standards, high speed building of 1000 jin fields, fields that produce two key links, and ton of grain fields in order to make contributions to the hastening of the building of large scale socialist agriculture.

1. Control Through Entire River Basin Projects and Master Projects

In following Chairman Mao's instructions to bring the Huai He under permanent control, and in carrying out the program of "the need to build mostly medium and small water conservancy projects while at the same time building the needed and possible large scale water conservancy projects," Jiangsu Province placed its main efforts on control of the Huai, carrying out large areawide drainage projects to guarantee wide area security against floods, solve the problem of farmland drainage and irrigation resources for large areas, and combine development of shipping with comprehensive utilization.

(1) Control of the Yi and the Shu Rivers

The flood season on the Yi, the Shu and the Si rivers breaks with tremendous force, and the volume of floodwaters is great. Formerly, because there was no place to which the waters could be drained, every place was inundated in a disaster. In light of this contradiction, following a program of taking care of both storage and releasing of floodwaters and adopting the methods of restraining waters from overflowing their banks by draining floodwaters away and by digging down deep and building embankments, the New Yi He and New Shu He riverbeds were first opened to the sea. This forced the floodwaters to remain in their channels to be discharged, thus bringing to a close a situation of flooding and inundation in the lower reaches of the Yi, the Shu, and the Si that had endured for several hundred years. Next, standards were steadily raised and the two large reservoirs on Luoma Lake and Shiliang He were constructed to increase floodwater retention capabilities. Sluice gate and mountain cut through projects were built at Suqian and Zhangshan for effective control, the Pi-Cang flood diversion channel was opened to help divert flood waters, and a project for the eastward diversion of the Yi and Shu rivers was undertaken to empty water out of Luoma Lake in order that it could take water from four lakes to the south. There was also gradual enlargement of the New Yi He and New Shu He projects to improve capabilities to combat floods and

discharge flood waters. The fourth stage of deepening and widening the main channel of the New Shu He has already begun for further increase in capabilities to dispatch floodwaters, and providing more advantageous conditions for future planning, taking all factors into consideration in finding an outlet for the floodwaters of the Yi, Shu, and Si rivers.

(2) Control of the Huai He

After flowing into Jiangsu Province, the Huai He empties into Hongze Lake. Below the lake lie the lower reaches of the Huai He. Hongze Lake has a surface area of 160,000 square kilometers, and during the greatest flood of 1931, its total volume reached more than 76 billion cubic meters, and its maximum flood level reached 16.25 meters. But the lake area to the west of the Grand Canal between the Lixia He and the low-lying lake plain and the central low-lying area are more than 10 meters lower than the flood crest of the Hongze Lake. Formerly flood waters from the Hongze Lake had only two exits: One was through the Zhangfu He across the Grand Canal, over the abandoned bed of the Huang He and through the Zhongsha He into the sea. The other was through San He across Gaoyou Lake and Shaobo Lake and back into river beds into the Chang Jiang. Since these exit routes were seriously inadequate, everytime there was a large flood, it could only spread out on the flood plain, and floodwaters inundated the entire Lixia He region, frequently running rampant.

The projects for the strengthening of the Hongze Lake dikes and the embankments of the Grand Canal, which were begun in the period immediately following Liberation, steadily continued subsequently. During the winter and spring of 1951 and 1952, the 168 kilometer long North Jiangsu Irrigation Canal was excavated for the diversion of waters from the Huai into the sea, the volume of floodwater discharge being from 800 to 1,000 cubic meters per second, while at the same time making use of it to carry water for irrigation. In 1953, China's 700 meter long second great floodgate, the large San He floodgate project was built for preliminary control of flood waters going through the San He floodgate through Gaobao Lake into the Chang Jiang. This used the low-lying lake land for retention of floodwaters for use in a combination of irrigation and shipping.

In order to further solve the problem of an outlet for floodwaters from the Huai, irrigation and shipping were developed on the plain to the north of the Huai. Between 1958 and 1960, a comprehensive project for the diversion of water from the Huai into the Yi was carried out. The project included the excavation of 195 kilometers of the Huai and the Shu rivers, and the building of the Er He floodgate, the Huaiyin floodgate, and the Shuyang floodgate, and such large scale control structures. Since the Hongze Lake has been linked to the Huai He and the New Yi He, floodwaters from the Huai and the Yi no longer converge; some of the Huai waters are diverted into the Yi and the Hongze Lake is discharged into the sea. During the irrigation season, waters from the Huai are carried northward to supplement the irrigation water used over a wide area on the Northern Huai Plain, and in the Yibei and Qiangwei river basins. Since the Great Cultural Revolution, the project for diversion of the Huai into the Yi has continued to be built, and now the waters of the Huai can be moved northward at a rate of more than 400 cubic meters per second.

Once the project has been fully built, it will be able to discharge water from the Huai and Hongze Lake at a rate of 3,000 cubic meters per second. During 1966 and 1967, all around strengthening was done of the dikes of Hongze Lake and a 50 meter wide wave shelter forest strip was put in place as well to improve flood prevention capabilities. In 1969, work got underway on dredging of waterways entering the river. Between Er He and Gaoyou Lake, a 3 kilometer wide, 18 kilometer long floodwater course was opened, and the 2 kilometer long San He river dam and the 12 kilometer long Dashanzi partition embankment were built for control of flooding and waterlogging. The large western embankment of the Grand Canal and embankments all along it were strengthened. As a result of all this, the volume of discharge into the Chang Jiang of Huai He water increased from the former 8,000 cubic meters per second to 12,000 cubic meters per second; the flood prevention battle line was shortened, irrigation was developed, and the cultivated land area was increased.

Simultaneous with flood control was firm attention to control of waterlogging. On several occasions, the great dikes along Hongze Lake, along the Grand Canal, and along the sea were reinforced, and along the seacoast were constructed sluice gates to stem the tide and drain away waterlogging. Principal water-courses for the drainage of waterlogging such as Doulonggang, Huangshagang, and Xinyanggang were dredged for a vast improvement in combat against flood in the Lixia He region and in capabilities to drain away waterlogging and prevent stagnation of water.

(3) Undertaking the North Jiangsu River Diversion Project and the Northward Movement of Waters from the South

Working from a foundation of the strengthening of flood prevention projects, active construction has been done since 1958 on a series of large scale irrigation facilities. In northern Jiangsu, a program of "storing, diverting, pumping, and transporting" has been pursued simultaneously with the emphasis going to the North Jiangsu river diversion scheme for the gradual northward movement of water from the Chang Jiang and the Huai in a free-flowing movement that redistributes the water resources of the Chang Jiang, the Huai, the Yi, and the Si, and that makes full use of surface water and ground water to develop irrigation areas of between 10,000 and 300,000 mu at more than 178 places.

The Northern Jiangsu River Diversion Project is an integral part of China's huge plan for the movement of southern waters to the north. Construction has already been completed on the Jiang-Dou water conservancy hub with a pumping capacity of 400 cubic meters per second, and on the Huai-An water conservancy hub with a pumping capacity of 150 cubic meters per second, providing a definite material foundation for the northward movement of southern waters. The Jiang-Dou water conservancy hub is the primary station for the North Jiangsu Chang Jiang diversion and the movement of southern waters to the north. This hub has four large pumping stations as its nucleus, and through the control and regulation of watercourses concerned and by using sluice gates, it is possible to pump water diverted from the Chang Jiang in the direction of the Lixia He and the area north of the Huai for irrigation, while at the same time combining this with the pump drainage of waterlogging water from the Lixia He region. During the irrigation season, irrigation can be

provided to 4 million mu of cultivated land along the Grand Canal and along both shores of the North Jiangsu Canal. When irrigation is not being done, the water can be sent through the Huai-An sluice gate project to add to water resources stored for irrigation in the Hongze Lake and the Luoma Lake.

(4) Building of Master Projects Along the Chang Jiang and in the Tai Lake Region

Along the Chang Jiang, a large number of projects to protect the shores have been carried out with general renovation and strengthening of river dikes and seawalls. Basically sluice gates have been built wherever there are ports; the Chu He flood diversion channel and the Tonglu Canals have been dug out; construction has begun on the Qinhuai He flood diversion project; various ports along the Chang Jiang such as Jiaogan have been dredged, and quite a few water recycling stations have been built along the shore to change drainage and irrigation conditions on both banks of the Chang Jiang. Some of the projects on the Taipu and Wangyu rivers have been completed. Excavation and dredging has been done in principal regional watercourses such as Qiputang, Liu He, Zhangjiagang, Yanglintang, and Huputang in an expansion of outlets for floodwaters from Lake Tai, and removal of flooding and waterlogging threats to several million mu of low-lying land around Yangcheng and Dingmao.

(5) Renovation of the Nanjing-Hangzhou Canal

The Nanjing-Hangzhou Canal traverses the Chang Jiang, the Huai, the Yi, the Shu, and the Si rivers in Jiangsu Province. It is the province's most important north-south shipping line and major water artery with extremely great ramifications for development of water conservancy and shipping. Because of many years lack of maintenance before Liberaton, its large dikes burst causing disaster, and its feeder streams were difficult to navigate. The gradual renovation done since Liberation, the dredging of the Inner Canal, the Middle Canal, the Huaibei Canal, and the Jiangnan Canal, the building of sluice gates, the strengthening of dikes, and the separation of rivers and lakes have solved contradictions among shipping and irrigation and flood prevention, not only assuring year round navigation, but also making it into a main watercourse for the northward movement of southern water and for regulation of water resources, and to play a very great role in blocking floods, draining waterlogging, and irrigating.

2. Mass Farmland Water Conservancy Construction

Since Liberation, the broad masses of peasants in Jiangsu Province have relied on the strength of the collective socialist economy to gradually complete large numbers of farmland water conservancy projects in concert with state operated large scale water conservancy projects. Following the deepgoing development of the mass movement of learning from Tazhai, in particular, a farmland capital construction movement was launched, with water control and soil improvement as its primary objectives, in a policy based on "small scale paramount, equipping paramount, and commune and brigade operation paramount." This resulted in new development in breadth and in depth of farmland water conservancy construction. In 1973, Jiangsu Province put forward a "six

criteria" proposal for assured harvests despite drought or waterlogging, with consistently high yields from fields. These criteria were "no waterlogging even with rainfall of 150 to 200 millimeters per day; ability to irrigate for 70 days without rainfall; control of the ground water table below 1 to 1.5 meters; leveling of fields and deep turning over to transform the soil, full equipping of facilities built, and overfulfillment of agricultural targets." Since 1975 there has been further clarification with proposals for the orientation of action and focus of farmland capital construction as follows: Full equipping and perfection of a river network system on the basis of the "six criteria." The point of departure is to be the building of large scale socialist agriculture, utilization and improvement being interrelated in a determined effort at improvement; simultaneous control over floods, waterlogging, drought, and water stagnation, the main attack being launched against waterlogging and water stagnation; an interrelationship of water control and improvement of the land to get full benefits from water conservation; and maintenance of comprehensive control and comprehensive use to gradually build the entire province into a water conservancy river network that is "able to withstand, can drain quickly, can reduce water levels, can irrigate well," that is fully equipped, that carries on garden-style agriculture, that is able to control, and is able to regulate to meet the needs of agricultural mechanization, and assure continued consistently high yields in agriculture.

In hilly regions, it is storage that is paramount, with simultaneous action to store, divert, raise, use wells, and regulate for ability to control drought, flooding, waterlogging, and water stagnation. Great efforts are to be made in separate treatment of mountains, flatlands, and low-lying areas, damming of water being done along contour lines, building of reservoirs in low-lying areas, and linking together of reservoirs and ponds for fully effective interception and storage of water, and to perfect a water system that can divert water and drain water away. There is to be improvement of the soil and leveling of the land, with the tops of mountains being flattened, the slopes of hills being terraced, garden style agriculture being done on alluvial fields, and cold waterlogged fields being eradicated. There is to be afforestation of barren mountains to preserve the soil against erosion. The province's hill region contains 8.8 million mu of cultivated land. By 1975 water irrigation resources had been controlled at an average 300 cubic meters per mu, the area of water control being 40 percent. Level terraced fields were built on 2.74 million mu, and farmlands from which consistently high harvests could be assured despite waterlogging or drought totaled more than 1.7 million mu. In low-lying areas crisscrossed by water networks, control was carried out on flooding from without and waterlogging and stagnation of water from within, the main emphasis going to elimination of waterlogging and curing water stagnation. Great efforts were devoted to individual enclosures and construction of dikes, to the joining of dike sections together, to reshaping the old river network, to the building of a new water system, to the development of machine pump irrigation and drainage, to the building of a drainage and irrigation ditch system, to fully equipping stations built at openings in the dikes, and to institution of "four separations and two controls" i.e. separation of the inner and the outer, of drainage and irrigation, of different levels, and of wetlands and drylands, with control of inland water levels and underground water table levels. Of the entire 23.9 million mu of cultivated land in the diked lowland

area of the province, more than 10 million mu have been turned into fields that produce consistently high yields despite drought or waterlogging, and capabilities to prevent flooding and water stagnation have also been conspicuously improved. In plains areas, comprehensive control of flooding, waterlogging, drought, water stagnation, and alkalinity have been effected, with principal efforts directed to curing the problem of waterlogging and prevention of water stagnation, and active solution to the problem of water resources for irrigation. Gradually requirements for "deepness, for networks, for separation, and for leveling" have been met, meaning the need for streams to be deep, the water system to be a network, control effected at separate levels, and level watercourses in the building of the water system. Slopes on the plains require terraced river networking, the adaptation of general methods to local situations for terrace control in separate areas and in separate sections, separation between high areas and low ones, contour damming of water, and the diking of lowland areas and the building of pumping stations in order to be able to eliminate waterlogging, change the farming system, prevent water stagnation, and combat drought. On more than 19 million mu of the provinces 38.1 million mu of cultivated land in plains areas, farmlands have been built that are able to produce consistently high yields despite waterlogging or drought.

3. Development of Electromechanical Irrigation

In order to improve the effectiveness of irrigation and triumph over flooding, waterlogging, drought, and water stagnation, while developing water conservancy and building farmlands, Jiangsu Province has also developed corresponding irrigation using machinery and power equipment. Moreover, in places lacking water resources but in which ground water is fairly abundant, it has developed irrigation from wells and the use of machinery and power equipment for well irrigation.

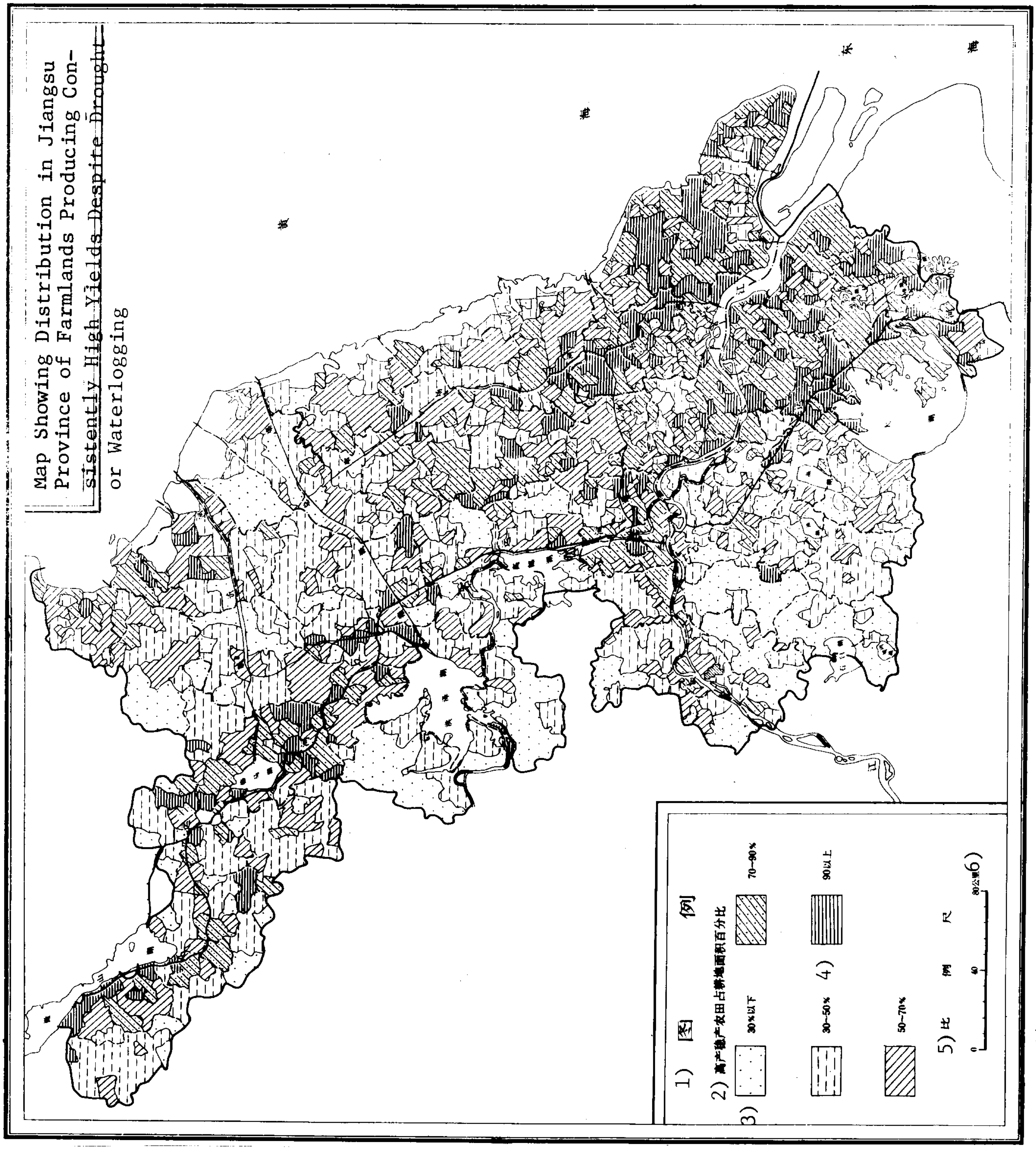
In 1975 the province had 3.54 million horsepower of equipment for pump irrigation and drainage and pump wells numbered more than 38,000, more than 31,000 of which were equipped with machine-powered equipment. Almost all communes and production brigades in the province had built fixed machine-powered drainage and irrigation stations, the area served by machine-powered drainage and irrigation amounting to 43 million mu. Development of machine powered drainage and irrigation has given impetus to building of water conservancy for farmlands, and improvement in effectiveness of water conservancy projects; it has also promoted the mechanization of agriculture, electrification, and development of commune and brigade industry. Today 96 percent of communes in the province are served by electricity, and it is put to use in all possible ways.

Second Section. Major Efforts to Improve the Soil and Increase Its Fertility

Since the founding of the People's Republic, Jiangsu Province has also won very great achievements in improving low yield soils and in improving soil fertility.

1. Development of Mass Soil Surveys

In order to understand and improve the soil, as early as the period immediately following founding of the People's Republic, some soil survey work was done. In accordance with instructions from the CCP Central Committee to launch mass soil survey work, and acting under the leadership of the Provincial CCP Committee and the Provincial People's Committee, during the first half of 1959 the province established the Jiangsu Provincial Soil Survey and Identification Commission for wideranging arousal of the masses and, in close combination with production, launched a mass soil survey throughout the province using leadership cadres, the masses, and technicians. Altogether more than 200,000 people participated in this activity over a period of 6 months. They victoriously completed soil surveys of about 80 million mu of mostly cultivated land in the province, and obtained a basic understanding of the types, fertility, cultivation situation, and productivity of the province's soils. They also rather systematically summarized the experiences of the masses in appraising, using, and improving the soil. From 1973 to 1976, all prefectures and counties again conducted representative soil fertility tests in communes and brigades, giving emphasis to an understanding of changes in soil fertility everywhere following reform of the farming system, and they summarized the new experiences of the broad masses in major efforts at improving the soil and nurturing its fertility. As a result of this series of actions, the "Eight-Point Charter for Agriculture" [soil improvement, rational application of fertilizer, water conservancy, improved seed strains, rational close planting, plant protection, field management, and improvement of farm implements] was put into effect in an adaptation of general methods to local soil conditions for purposeful use of soil resources. Planting, cultivation, fertilization, and irrigation were done in accordance with soils. Low yield soils were effectively improved and high yield soils were nurtured in a guided way. This provided scientific data about the soil for the building of farmlands that produce consistently high yields and for the formulation of agricultural production plans. It also gave impetus to the development of pedology in Jiangsu Province.



1. Legend
2. Ratio of Consistently High Yield Fields to Total Cultivated Land Area
3. Less Than 30 Percent
4. More Than 90 Percent
5. Scale
6. Kilometers
7. Figure 14

2. Improvement of Low Yielding Soils

Results of the 1959 mass soil survey showed that 22.03 million mu of the province's 78.36 million mu of cultivated land contained low yielding soil. This was 28 percent of the total cultivated land area. In drylands, saline-alkaline type soil accounted for the greatest amount of the low yielding soil area. Next were the heavy waterlogged drylands, the infertile sandy soils, and the mucky [0545 3364] soils. In wetlands, cold, damp clayey type soils accounted for most of the soil area that produced low yields. Next were the infertile illuvial types. For the past more than 10 years the broad masses of poor and lower-middle peasants went all out to improve low yielding soils, and now between 50 and 60 percent of the low yielding soils have been improved in varying degrees.

(1) Improvement of Cold Damp Clayey Type Low Yield Paddy Soil

By cold, wet, clayey type low yield paddy fields is meant principally waterlogged soil, most of which is located in the Lixia He area, and secondly in the Lake Tai area. Before 1958 there was approximately 5 million mu of such soil. Between 1958 and 1965, 1.5 million mu of it was improved, and between 1965 and 1970, most of the remaining 3.5 million mu was improved. Former single crop waterlogged fields were changed into doubling cropping fields growing rice and wheat, and soil fertility was improved in varying degrees. Improvement of such low yielding soils required, first of all, major efforts in water control with improvement of drainage conditions and lowering of the ground water table. Second was increased applications of phosphate fertilizer to increase the supply of quick acting phosphate. Finally was the rotational cropping of paddy rice with wheat, barley or naked barley, green manure, and rape for improvement in the soil's porosity, and lowering the soil's gley horizon, changing it from an "Ag horizon" to a "bottom horizon" [1646 3383], thereby making use of the latent fertility in the soil. The change from one crop to two crops each year also greatly increased the soil utilization rate.

(2) Infertile illuviam type low yield paddy soil includes the stiff belozem of the Zhenyang hill region, the diansha [3434 3559] soil of the Lake Tai Plain, and the porous illuvial sandy soil of the area along the Chang Jiang. As a result of much growing of green manure, applications of phosphate fertilizer, the growing of duckweed, the composting and application of waterlogged compost, and improvement in drainage conditions, about 50 percent of such soils have been improved. The stiff, mucky properties of the soil have been virtually eliminated, and the organic content has been raised from between 1 and 1.5 percent to 1.5 to 2.0 percent.

(3) Improvement of Saline-Alkaline Type Low Yielding Dryland Soils

Saline-alkaline type low yielding dryland soils are the low yielding soils covering the largest area in Jiangsu Province. The 1959 soil survey showed a total of 13.74 million mu, or 65 percent of all the low yielding soil in the province as being of this kind, 7.8 million mu of it being mottled alkaline soil [0553 4354 0960], and 5.94 million mu (including desalinated soil) being saline soil. Following the establishment of people's communes, steady major

efforts have been made to improve saline-alkaline soils and to summarize a series of experiences in soil improvement of "a combination of water, green manure, and afforestation, and planting followed up with care for all around control," by which is meant the building of ditches to drain away water for use in flushing away alkali and salt; large scale planting of green manure, using the green manure to fertilize the fields; planting of trees for afforestation to prevent salinization and assure yields; adaptation of general methods to local situations in rotational cropping; and intensification of care in intensive farming. With improvement in water conservancy conditions, all jurisdictions enlarged the area of "alkalinity transformed by water," hastening the pace of saline-alkaline improvement. Now, more than half the province's saline-alkaline land area has been improved in varying degrees. In the period immediately following Liberation, the saline-alkaline wasteland surface layer had a salt content around 0.2 to more than one percent; in cultivated land, the salt content was 0.2 to 0.4 percent. A survey done in 1962 shows the saline content of cultivated soil in all prefectures to have declined to around 0.1 to 0.25 percent. As of 1973, except for some saline-alkaline spots along the coast and to the north of the North Jiangsu Canal, salinity in the cultivated layer of soil has declined to generally less than 0.1 percent.

(4) Improvement of Infertile Sandy Low Yielding Dryland Soils

Formerly sandy infertile low yielding dryland soils covered 1.13 million mu in the province, including 700,000 mu of blown sand and soaked sandy soil, and 430,000 mu of goutou [3699 7333] sandy soil. As a result of the planting of shelter forests to break the wind and stabilize the sand, and after the planting of fruit trees, peanuts, day lilies, and such sand tolerant crops, plus the growing of green manure, between about 60 and 70 percent of the blown sand has been improved. As a result of turning under the sandy top soil to mix it with the silty bottom layer, and the mixing with the sand of soil hauled in from elsewhere, plus large scale planting of green manure, today about 50 percent of the infertile, sandy soil has been improved in varying degrees.

(5) Improvement of Heavy, Dry and Waterlogged Low Yielding Dryland Soils

Heavy, dry and waterlogged dryland soils largely consist of some sajong black soil and formerly covered an area of 2.14 million mu. As a result of improvement in drainage conditions and the development of irrigation, not only has the problem of aridity and waterlogging been solved, but as a result of their conversion from dryland to wetland fields and large scale growing of green manure, in more than half of them the soil fertility has been strikingly increased and the crop yields per unit of area increased manifold.

(6) Improvement of Mucky, Sandy, Infertile Low Yielding Dryland Soils

Mucky, sandy, infertile low yield dryland soils means the mucky soils of the hills north of the Huai, which formerly covered a 810,000 mu area. As a result of deep turning over of the soil, construction of terraced fields, the building of ditches to drain away stagnant water, the digging of ponds to store water and combat drought, the planting of green manure, increased

applications of phosphate and potash fertilizer, and the growing of crops suited to the soil, preliminary improvement of between 30 and 40 percent has been attained.

3. Building Up Fertility Resources, and Nurturing Fertile Soil

Even while they were engaged in major capital construction of farmlands, vigorously improving drainage and irrigation conditions, and leveling the soil, the broad masses of cadres and people in Jiangsu Province were using various measures such as planting, breeding, accumulating, and cropping to actively build up fertility resources and to nurture fertility of the soil, thereby generally increasing soil fertility. Now, the province's wetlands fertile soil area stands at about 50 percent, and the drylands fertile soil area stands at about 30 percent.

(1) Large Scale Planting of Green Manure

Up until 1964, the area planted to winter green manure in the province fluctuated for a long time around 5 million mu. After the launching of learning from Dazhai in agriculture, the winter green manure area broke 10 million mu in 1966, and jumped to 15 million mu in 1969. Year round green manure of "three water crops [hollow stalk swamp cabbage, water hyacinths, and water lettuce] and one duckweed" also rapidly developed. The area planted to green manure in the province reached 34 million mu in 1975, including 16 million mu planted to winter green manure, 8 million mu planted to summer green manure, 2 million mu planted to "three green manure water crops" [hollow stalk swamp cabbage, water hyacinth and water lettuce], 4 million mu planted to duckweed green manure, and 4 million mu planted to mulberry groves, fruit orchards, and green manure in the 10 besides [beside streams, villages, houses, roads, etc] for an average of 1 mu of green manure for every 2 mu of cultivated land.

Development of green manure production in Jiangsu Province has been characterized by the following: (1) Development from green manure in a single season to green manure in all four seasons. The Lixia He region changed waterlogged fields to drylands and developed winter green manure; the Xu-Huai area switched from fallow winter fields to the planting of winter green manure, and changed from summer harrowed fields to the growing of summer green manure; areas along the Chang Jiang and along the seacoast went in big for the intercropping and companion cropping of green manure. (2) Development from planting as a single crop to intercropping, companion cropping, and transplanting. During the summer season, cotton fields are companion cropped with sesbania, mung beans or false hemp. In the fall they are companion cropped with summer or winter green manure crops such as Chinese trumpet creeper, bur clover, or broad beans. In dryland grainfields, intercropping of wheatfields is done with rows of bur clover or Chinese trumpet creeper, or else fields are companion cropped with sweet clover. Corn rows are intercropped with sesbania, false hemp, or mung beans. Carrot fields and sugarcane fields are intercropped with Chinese trumpet creeper and such overwintering green manures. During the winter season, rice fields in different areas are sown to various kinds of green manures, planting being done according to the soil and according to the

crop rotation system. In the area north of the Huai, formerly winter green manure consisted only of Chinese trumpet creeper, which caused problems in the cropping system. In recent years, as a result of the inoculation of root nodule bacteria, introduction of Chinese milk vetch has been successful, and by 1975, it had spread to more than 400,000 mu. Jian Kuo [4628 4584] peas, a new variety of green manure with fairly high output of both vegetation and seeds has also rapidly spread to a large number of places. (4) Development from dryland crop green manures to green manures that grow in water, with the growing of "three green manure water crops and one duckweed" gradually spreading from the Lake Tai region northward throughout the entire province. (5) Development from a single variety of green manure to a mixture of varieties, with "mixing of three, four or five kinds"* in order to increase the output of fresh plant material, and make the most of the green manure's effectiveness for steady increases in grain and cotton yields.

(2) Large Accumulation and Large Creation of Farmyard Manure

Major efforts have been made in the raising of hogs and the collection of hog manure, which has supplied large quantities of high quality organic fertilizer. In 1975, live hogs raised in the province numbered 33.35 million head, an average of 0.5 head per mu of cultivated land. Improvements were also made in the collection and storing of manure, some places that had formerly pastured hogs now raising them in pens.

In recent years, waterlogged compost has also seen great development. Formerly it had been confined to the Lake Tai area, but now not only has such composting and use spread to the Zhenyang hill area and the Lixia He area, but it is also in process of spreading to the drylands that have been turned into wetlands in the Xu-Huai area.

The "duckweed repositories" pioneered by Taixing County permit year round multiplication of duckweed for use on both rice and wheat. The "year round fertilizer maker" created in Wu County permits year round accumulation of superior quality concentrated fertilizer, and is being promoted in rice growing areas. Considerable development has also occurred in the making of humic acid and bacterial fertilizers.

(3) Increased Use of Chemical Fertilizers

Quantities of chemical fertilizers used have also steadily increased. During the period immediately following founding of the People's Republic, the quantity of chemical fertilizer used in the province was extremely small. According to statistics from agricultural means of production companies, in 1952 the amount used was only 16,200 tons. In 1975, the quantity of nitrogenous fertilizer used amounted to 997,700 tons (converted into standard fertilizer), for an average of 18 kilograms per mu of cultivated land. Phosphate fertilizer use stood at 494,400 tons, an average 5.4 kilograms per mu.

*Meaning the growing of three, four, or five different kinds of green manure, intermixed, or alternately sowed on a single plot of land according to definite seed proportions and different planting methods.

In order to increase effectiveness of chemical fertilizer, wide areas have also promoted economically sensible fertilizer application techniques, such as deep application or injection application of ammonium carbonate, or concentrated application of phosphate fertilizer "using phosphate to increase benefits obtained from nitrogen."

Third Section. Reform of Farming System

Reform of the farming system to increase the multiple cropping index is an effective way of making full use of water, soil, and heat resources to tap potential for increased agricultural yields. While devoting major efforts to the capital construction of farmlands with the emphasis going to water control and soil improvement, since the founding of the People's Republic Jiangsu Province has also adapted general methods to local situations to turn drylands into wetlands, to turn waterlogged fields into drylands, and to growing three crops where two crops have been grown, for a change in the system of farming. It has also developed a system of intercropping and interplanting, winning remarkable successes in all these efforts.

1. Changing Drylands to Wetlands

The change of drylands to wetlands has been concentrated in the Xu-Huai area and in the high sandy areas along the Chang Jiang where almost 10 million mu had been changed as of 1975. This amounted to more than 15 percent of the province's collectively farmed area, and about 30 percent of the cultivated paddy rice area (not including multiple cropping). Large area conversion of drylands to wetlands has been a great success in the province's improvement in utilization of nature.

Water, soil, and heat resources in the Xu-Huai area suit either dryland or wetland agriculture. However, before Liberation floods, waterlogging, drought, and alkalinity disasters were frequent, and individual peasants who were subjected to the exactions of reactionary rule had no way in the world to withstand them. Thus, they could only passively adjust to nature, carrying on a farming system that largely produced three dryland crops every 2 years. Analysis of contributing factors shows mainly that: (1) in order to deal with climactic characteristics of spring drought, summer waterlogging, and autumn drought, there was selection of dryland hybrid grain crops able to tolerate drought and tolerate waterlogging, plus establishment of a corresponding rotational crop system to avoid disasters and assure harvests, settling for consistently low yields; (2) to meet declining soil fertility, different crops were planted in different seasons, and winter fallow with summer harrowing were used to improve the physical structure of the soil and release effective nutrients to revive soil fertility. In addition, still another important reason was local insufficiency of draft animals and fertilizer.

Following Liberaton, under the leadership of the party large scale water conservancy construction and major projects for farmland water conservancy were carried out to revive and develop agricultural production. These substantially brought under control flood disasters, diminished waterlogging disasters, and developed irrigation, creating favorable conditions for the conversion of drylands to wetlands. In 1956, through a combination of "reform of the farming

system and elimination of waterlogging, the conversion of drylands to wetlands was begun in lowlying marshlands. This was followed by the "growing of rice to change alkalinity" in mottled alkaline lands, both achieving striking results. In 1965, the paddyfield area expanded to 1,437,000 mu, and paddy output totaled 378 billion jin. Throughout the rice growing areas, the farming system of one crop each year or three crops every 2 years was changed to one crop of rice and one crop of Chinese trumpet creeper, or a crop of rice and a crop of wheat each year for an increase in the multiple cropping index. During the past 10 years, the building of consistently high yielding fields has thrived, with principal efforts being devoted to control of water and improvement of soil. This has further improved basic conditions for agricultural production, thereby greatly increasing the pace of conversion of drylands to wetlands. In 1975, the rice growing area totaled 7.9 million mu, and paddy output totaled 3.4 billion jin for increases over 1965 of 4.5 times and more than eight times respectively,

In the conversion of drylands to wetlands in the Xu-Huai region, full use of light energy, heat, and water resources to steadily tap potential for increased yields was one of the effective methods used. First of all, the climate of the Xu-Huai region is relatively mild, annual accumulated temperatures over 10°C amounting to between 4340 and 4690°C. The safe growing period for rice averages 205 days annually, enough to fully satisfy growing season needs of all rice varieties planted. In addition, moisture requirements are largely assured through precipitation, surface runoff and ground water resources in the region. More than half the annual precipitation is concentrated during the period from June to August when the rice needs it most. Moreover, before the rainy season begins, by using water conservancy facilities such as rivers, lakes, reservoirs, and ponds, more than 5.5 billion cubic meters of water can be stored, virtually assuring irrigation for the paddy rice. Conversion of drylands to wetlands both fitted in with the large amount of water available during the summer season, and permitted a "change in the farming system with elimination of waterlogging," and "growing of rice to improve alkalinity," linking together combat against disasters, increased yields, and soil improvement. Full expression was given to the adaptation of general methods to local situations, turning disadvantages into advantages, and changing low yields into high yields. Third, after the change to wetlands, growing of all kinds of green manures rapidly developed for an organic linkage of soil use with soil nurture. The passive methods for nurturing soil of winter fallow and summer harrowing used in the past were changed to active nurture of the soil to increase its fertility and win continuously high crop yields. This opened broad avenues for making further full use of nature.

Outstanding results have been achieved in increased yields from the conversion of drylands to wetlands. For a long time this region had been subjected to numerous kinds of disasters and low yields, and had never been self sufficient in grain. Following large area conversion of drylands to wetlands, the speed of increase in grain yields was very rapid. With the institution of a rice and a wheat crop in a single year, yields per mu more than doubled as compared with the past when drylands produced three crops in 2 years. In 1973, the entire region was virtually self-sufficient in grain production. In 1975, the region's grain output totaled 9.8 billion jin, more than 34 percent of it being paddy rice.

As farmland capital construction progressed, the high sandy soil areas along the Chang Jiang, in coastal reclamation areas, and in the hilly and slopeland regions of Zhenyang also carried out a conversion of drylands to wetlands over a certain area. In the high sandy soil areas, heat and moisture conditions are fairly favorable, and as a result of vigorous development of water conservancy construction and leveling of the land, the dryland area that has been converted to wetlands now amounts to about half the total cultivated area. A rotational crop system whereby wetland and dryland crops are rotated for five harvests every 2 years, which has changed the system of farming and produced increased yields, has been very remarkable.

2. Transformation of Waterlogged Fields to Drylands

The transformation of waterlogged fields to drylands is yet another major accomplishment of Jiangsu Province in improving on the use of nature, changing low yields to high yields. Waterlogged fields are concentrated in the Lixia He region, and amount to one-half that region's cultivated area. The region's terrain is low-lying; "four rivers puddle here," and the "water from the west" [the Chang Jiang] frequently causes disasters. Historically, flooding and waterlogging disasters have been extremely severe. For millenia the waterlogged fields have produced "a single crop of paddy rice each year, waterlogging occurring 9 out of 10 years." The existence of a single crop from waterlogged fields was entirely the result of the passive way in which nature was dealt with under the small scale agricultural conditions of the old society. Inasmuch as flooding and waterlogging usually took place after beginning of autumn [around 7 August], it was necessary before beginning of autumn to rush plant one crop of early maturing "native variety" xian rice if disaster was to be avoided and a harvest assured. Xian rice places not very high demands on soil fertility, and it is fairly easy to get consistent yields from it in soils where effective nutrient levels are not high. Soil nurture and methods of increasing soil fertility were also quite backward. After the rice was harvested, in order to guard against dessication and deterioration of the soil, careful attention was given to timely plowing and harrowing while the soil remained waterlogged in order to hasten the rotting and decomposition of rice straw and other organic matter, thereby reviving and maintaining soil fertility. The so-called "plowing in the seventh (lunar month) is excellent, and plowing in the eight (lunar month) is good, but plowing in the ninth or tenth (lunar month) is killing, "and" fertilizing three times in the fall without furrowing, and fertilizing three times in the spring without harrowing," summarized experiences of the time in soil improvement and the nurturing of fertility. Furthermore, a single crop a year from the waterlogged fields meant too low a multiple cropping index. This region has more abundant heat resources than the Xu-Huai region, enough to satisfy the needs of two crops a year with some to spare. The large amount of fertile earth was far from being fully used. Early maturing xian rice produced low yields of only about 200 jin per mu for the entire year, far from making the most of potential for increased yields. Since the waterlogged fields had long soaked in water, most paddy fields were loaded with water, so in low-lying places where drainage conditions were poor, and farming was done in a careless fashion, no improvement was made in large areas of low yield soil. In the waterlogged fields, the mud covered ones feet, and in cold weather, fields were plowed and

harrowed by implements pulled by people in an extreme expenditure of labor. Therefore, improvement of the waterlogged fields, and improvement of farming methods for waterlogged fields has long been an urgent requirement of the poor and lower-middle peasants.

Following Liberation, in the wake of the socialist reform of agriculture and steady development of agricultural production, the people of Lixia He carried forward a spirit of fight against nature, and concurrent projects for the control of whole river basins such as that of the Huai, and master projects for control, they did much building of farmland water conservancy, linking existing dikes, constructing new dikes, and building sluice gates. At the same time, they divided up overly large low-lying areas with separate dikes, dug drainage ditches across the middle of them, developed pump irrigation and drainage, lowered the ground water table, and improved capabilities for pump drainage. After fundamentally bringing flooding and waterlogging disasters under control, they created conditions for large scale conversion of waterlogged lands into drylands. Following more than 10 years work by the broad masses of cadres and people, by 1970, 5 million mu of waterlogged fields had been largely converted to drylands, a fairly complete rotational cropping system that practiced both wetland and dryland agriculture for the growing of rice, wheat, cotton, and green manure (or rape) was established; the multiple cropping index was doubled; the process of soil maturation was advanced; crop yields were effectively increased; and the former extremely heavy burden of physical labor that commune members had to bear was eliminated. In the course of their experience with reforming the farming system, the masses directed attention to the problem of a halt to further composting with resultant deterioration of the soil. Immediately following the rice harvest, they drained away water, turned the soil and sunned it, and after sunning, they kept water on it to change soil properties. Application during the same season of ash fertilizer, or phosphate fertilizer, as effective measures for nurturing fertility and improving the soil in the growing of wheat (or rape, sesame, or green manure) was effective in the same season in changing to drylands and increasing output, and played an active role in man's triumph over nature. In addition, with the introduction of superior varieties of paddy rice, output quickly rose and in summer another crop of wheat, barley, or naked barley was harvested, increasing grain yields per unit of area by about 1.5 times and increasing considerably total output as well, the area becoming yet another major grain base in Jiangsu Province. Furthermore, the transformation of waterlogged fields to drylands also helped speedy development of the mechanization of agriculture, and opened a broad avenue for further development of two crops of rice in a triple cropping system.

Around the shores of Yancheng Hu in the Lake Tai farming regon, in the lower reaches of the Sheyang He in farming regions along the coast, and in the Bin Jiang lowlands along the Chang Jiang in Jiangsu Province, there formerly were some habitually waterlogged fields, in a situation similar to the one described above. As a result of the transformation done since Liberaton, a change was gradually made to a wheat and a rice crop, or two crops of rice, each year in a triple cropping system to make use of the soil's potential.

3. Development of Triple Cropping System

Development of a triple cropping system, chanpe from a single crop of rice to a double crop of rice each year, and change from a double cropping to a triple cropping system, is a way in which regions in the province with an already high level of agricultural output can further improve use of nature and can, through increase in multiple cropping and tapping potential for increased yields, realize even higher outputs.

In Suzhou Prefecture, the farming system has historically been predominantly a two crop one with the growing of paddy rice and wheat. Following the cooperativization of agriculture, geng rice replaced xian rice, superior varieties replaced local varieties, short stem varieties replaced early maturing varieties, yields per unit of area for single crop paddy rice thereby increasing. Before the Great Cultural Revolution, the Lake Tai region grew mostly geng rice while the Ningzhen hill region grew mostly xian; both were suited to production conditions at that time in those places. By 1965, in Wujiang and Wuxian in the south where water and heat conditions were favorable, after paddy rice became part of the "National Program for Agricultural Development," in order to explore a way to continued increases in yield, promotion of two rice crops began on the basis of many years experiences in Wujiang County with the growing of two crops of rice. This system was expanded from the Lake Tai regon to coastal regions and to the hill region of Zhenjiang, and in 1967 the Lixia He region also did test planting. In 1965, the area planted to two crops of rice amounted to 440,000 mu, and despite the slow development, the experience at that time showed that "for rice to exceed the "National Program," a single crop of rice would do; for rice to exceed 1,000 jin [per mu], the way lay in reform of the farming system." In order to go from high yields to higher yields, one major way was to change from a double cropping system of rice and wheat to two crops of rice in a triple cropping system.

A change from a double cropping system to a triple cropping system requires solution to the following several problems: (1) Tight scheduling of growing seasons, solving the problem of how in a 360 day period during a single year to get the more than 450 days needed for crops to reach maturity in a triple cropping system; and how in a frost-free period of from 220 to 235 days to find the 240 to 250 days necessary for full maturity of two crops of rice. (2) When farm work is already heavy, planting of another crop of rice will mean that farm work will become extremely hectic. During late July and early August, during a period of about 20 days during the "three rushes," farm work is extremely intense, and only by making the most of every second will it be possible not to miss the farming season. (3) Fertilizer requirements are great. To grow three crops instead of two, fertilizer sufficient for an additional season will be necessary, and if fertilizer does not suffice, there can be no increase in yields.

During the Great Proletarian Cultural Revolution, the broad masses of poor, and lower-middle peasants dared to experiment, and dared to innovate. In the course of the production struggle, they accumulated experiences in successful conversion to a triple cropping system, and they won rich accomplishments in their efforts to wrest time from the heavens and benefits from the soil.

First of all, they took firmly in hand the replacement of varieties and reform of seedling growing techniques to steal a march on the seasons and assure high yields from each and every crop. They introduced early maturing high yield early season rice varieties, and low temperature tolerant, high yield, late season rice varieties to take the place of the former late maturing low yield varieties. In the case of summer ripening crops, they cut back on the growing of late wheat in favor of expanded planting of early maturing barley and naked barley and early ripening rape, plus active breeding of early ripening wheat so as to get early crop turnovers. They thereby advanced and shortened the growing periods.

The techniques of seed propagation also saw steady new breakthroughs. For early season rice, a change was made to sparse sowing in water for the propagation of seedlings that were ventilated, and use of plastic sheeting to propagate seedlings. Two stage propagation of seedlings was done, the number of rotted seedlings in the early rice crop thereby being reduced, and early sowing with early transplanting being done. Intermediate varieties were substituted for early ones, and late varieties substituted for intermediate ones to enlarge intermediate and late maturing and early maturing varieties, and use was made of the lengthened late rice transplanting season to increase quality of rice seedlings. In this way it was both possible to advance by some days the ripening date for the rice, getting increased yields as well, and at the same time moderate conflicts between harvesting and sowing seasons.

Secondly, using high yields from each and every crop as a prerequisite, consideration was given suitable staggering of farm work so as to avoid the excessive concentration of farm work during a single period of time. A proper planning of distribution of varieties was done that included sensible crop rotation of early, intermediate, and late crops to avoid the necessity of cutting an early crop before it was fully mature or waiting beyond the proper time to transplant the succeeding crop. The goal was to achieve high yields for the present crop and to have the initiative with the succeeding crop so as both to make fullest use of effective accumulated temperatures and to tap the soil's production potential. This also readjusted somewhat the commune members' labor intensiveness.

Third was expansion of sources of fertilizer. Positive use was made of nitrogen fixing pulse crops and green manures; much growing of duckweed in rice paddies was done; and full use was made of unused water surfaces for large scale growing of "three green manure water crops" [hollow stalk swamp cabbage, water hyacinths and water lettuce], use of the "three green manure water crops" to promote "three nurtures," and of the "three nurtures" to promote "three crops." At the same time, major efforts were made to collect and make other organic fertilizers and to improve methods used for fertilizing, so as to increase fertilizing standards and efficiency.

In the process of changing from a double cropping to a triple cropping system, the broad masses of poor and lower-middle peasants devoted themselves as to a revolution, and in a do or die spirit, carried on a struggle to remake nature. The Longqiao Production Brigade in Wu County, where each person had only 0.8 mu of land on which to make a revolution, was first to make a 100 percent change from two crops to three crops each year. After 1969, its grain yields

continued to exceed 1,000 jin per mu in overfulfillment of the two key links and in overfulfillment of a ton of grain. In the wake of this aforementioned crucial breakthrough, in 1975 Suzhou Prefecture's three crop area expanded to encompass 76.4 percent of the total rice growing area. Driven by the zeal of Suzhou Prefecture, the triple cropping system rapidly spread to the hill region and both north and south of the Chang Jiang, and steady improvement in matching of varieties found further consolidation and development. By 1975, the area in which two rice crops were grown in a triple cropping system reached 10.83 million mu, or 31.5 percent of the total area sown to paddy rice and a more than 23 fold increase over 1965. In the triple cropping system, green manure - rice - rice was grown in 47 percent of places; wheat - rice - rice was grown in about 37 percent, and rape - rice - rice in about 9 percent. In addition, a system of "two dryland and one wetland" crops in which wheat, corn, and rice were grown was used in about 7 percent of the places. In recent years, in the process of developing the triple cropping system, all locales have implemented a program of "taking grain as the key link for all around development, adapting general methods to local situations, and concentrating as appropriate." They have combined use of the land with nurture of the land, and have created diverse new forms of a triple cropping system such as wheat - rice (or corn) - sugar (sugarbeets), or wheat - melons (pumpkins) - rice, or wheat - peppermint - rice in areas along the seacoast or along the Chang Jiang, and wheat - corn - potatoes in the Xu-Huai region, etc. This has accumulated abundant experiences for the province in the adaptation of general methods to local situations for development of the triple cropping system.

Development of the triple cropping system increased the multiple cropping index and gave impetus to tremendous increases in grain outputs. In the case of Suzhou Prefecture, for example, the multiple cropping index increased by more than 55 percent as compared with before the change in the system, and the province's total output of grain increased by more than 1 billion jin. Wu County's agricultural units estimate an approximate 30 percent increase in grain output directly attributable to a change in the system. As a result of expansion in the planting of late crop rice alone, the province realized an increased output of 4.2 billion jin of grain as compared with 1965.

4. New Development of Intercropping

Intercropping is an effective way by which a compound plant colony structure of different crops can be formed through human manipulation to achieve consistently high yields. This has been a traditional farming practice long used in intensive farming in some parts of Jiangsu Province. Use of intercropping (or mixed cropping) and interplanting (or transplanting) permits use of the mutually beneficial relationships that exist in growing different crops together, full tapping of space and time potential, increase in the light energy utilization rate, improvement in the microclimate of fields, and making the most of advantages at the edges of rows. At the same time, it permits more equitable absorption of nutrients and moisture from all strata of the soil, and the balancing and improvement of soil fertility. It also permits control of disease, insect, and weed pests. With proper crop selection, and sensible intercropping, benefits may be attained in combining soil use with soil nurture with increased output and increased earnings.

Accompanying the steady progress in agricultural production in both depth and breadth since Liberation, intercropping in Jiangsu Province has seen further realization and development and has, like other changes in the farming system, played a role in increasing yields per unit of area.

Characteristics of new development of intercropping have been the following: (1) An increase in the number of crops intercropped. The universal spread of the practice of intercropping, mixed planting, or transplanting of green manure, the organically related arrangement of grain, economic crops, green manure, and animal fodder crops, and the ingenious farming methods that produce greater harvests, in particular, have meant raising intercropping to a new plane. For example, coastal regions developed intercropping of grain (corn) with cotton, wheat with green manure (broad beans, bur clover), oil bearing crops (ramie) with green manure, interplanting of cotton and wheat, and mixed planting of wheat and green manure. In areas along the Chang Jiang, intercropping of grain (corn) with oil bearing crops (peanuts) has been done, and grain and animal fodder or green manure and animal fodder have been interplanted. The Xu-Huai region pioneered "interplanting of cotton and wheat with transplantation of two green manures," and "growing of two grain crops with transplanting of one green manure crop." (2) The method of intercropping and interplanting has as its goal benefits for the growth of the next crop to be grown and all around increases in yields and earnings. In achievement of this goal, through an adaptation of general methods to local situations, it has developed from the simple to the complex. Along the seacoast, for instance, grain and cotton grow in a "two intermingled with two" system. In the fall, two small rows or one large row of wheat are planted together with two rows of green manure, and in spring two rows of cotton and a single row of either two stalks of corn or a single row of closely planted stalks of corn are intercropped. In the high sandy soil region along the Chang Jiang, wheat and green manure are paired in either the double blank or single blank system. In the former, the green manure is sown on both sides of each plot, wheat being sown in the middle of the plot. In the latter, green manure is sown on one side of the plot and interspersed with wheat. This latter form may be further divided into two different methods. One is the "alternating method" whereby wheat and green manure are interplanted. The other is with wheat adjoining wheat in two adjacent plots, and green manure adjoining green manure in a "back to back system." If corn is sown following the green manure, and peanuts sown after wheat has been harvested, the "back to back system" is used in order to enlarge the width of the tract on which the peanuts are sown so as to minimize shading by the corn. If soybeans are sown after the wheat has been harvested, since the soybean stalks grow tall and are tolerant of shade, the "alternating method" is used. Many parts of the province have been in the habit of interplanting winter green manure, and in recent years, in addition to intercropping grain with grain or grain with economic crops, inter-transplanting of spring and summer green manure has developed. This is done in a large number of ways depending on growth of different major crops and on requirements of successor crops, or intercropping at different times. Depending on these various needs, intercropping of green manure is done early, in the mid period, or late for plowing under as a supplemental fertilizing, or to serve as the basic fertilizer for the subsequent crop, both of which function in increasing yields and nurturing the soil. (3) Intercropping has been expanded from a single season to a year round practice.

Along the seacoast, for instance, wheat and green manure are intercropped, the green manure being turned under in the spring for the interplanting of corn, and potatoes being transplanted after the wheat has been harvested for three plantings and three harvests within a single year. In the Xu-Huai region, wheat and cotton are intercropped and two crops of green manure are transplanted, the two green manure crops helping the two harvests. Numerous communes and brigades have gone in big for intercropping, interplanting, mixed planting, and transplanting of green manure, developing it from a single season to a year round practice, attaining fields that are green with either green manure, grain (or cotton) for year round nurture and use. (4) Intercropping has spread from some areas to every part of the province. Formerly intercropping was dominant in coastal areas where population is large relative to arable land, and there it was concentrated largely in dryland areas. Now, however, it has developed everywhere in the province. As a result particularly of the migration from the north to the Lixia He and the Xu-Huai region of Chinese milk vetch, and the southward movement across the Chang Jiang of summer green manure, not only are drylands intercropped with green manure, but wetlands are also transplanted with it. In addition, mixed cropping with green manure can also increase plant disease resistance, increase the density and height of green manure, and make full use of space and light energy, thereby increasing yields per unit of area. Consequently, its area of spread has increased.

Development of intercropping has brought about striking increases in output. For example, the Qunce Production Brigade in Dongtai County intercropped grain and cotton, harvesting grain yields of 1,803 jin per mu and cotton yields of 215 jin per mu in 1975. After intercropping cotton and wheat and transplanting two crops of green manure, Cangji Brigade in Siyang County harvested 1,410 jin per mu of wheat and 140 jin per mu of cotton. As a result of intercropping and rotation of crops by some communes in Nantong, Rugao County, grain yields were 1,000 jin, animal fodder yields were 10,000 jin, and sugar yields were 300 jin per mu. Of course, expansion of intercropping at the present times means conflicts in demands for labor and in the planting and harvesting seasons. It also makes for difficulties in farming with machinery. It also requires breeding of early ripening high yield varieties suitable for intercropping, further improvement in transplanting techniques, and gradual standardization and finalization of forms to help expand use of machine production.

CSO: 4007/157

CHAPTER 3. DISTRIBUTION OF AGRICULTURAL PRODUCTION AND AGRICULTURAL SUB-ZONES

Nanjing JIANGSU NONGYE DILI [AGRICULTURAL GEOGRAPHY OF JIANGSU] in Chinese Jun 79 pp 56-68

[Text] In order to meet the needs of different stages of development of the national economy, since Liberation Jiangsu Province has acted in accordance with conditions and characteristics of agricultural production in various places within the province to reform and restructure in a planned way the former distribution of agricultural production, making it increasingly rational.

First Section. Fundamental Characteristics of Agricultural Production

Because of the transitional character of the natural area in which the province is located, the rather complex types of soils, differences in the length of time in which agricultural production has been carried on, and differences in the proportions of population to land, the following characteristics of agricultural production have resulted.

1. Great Variety in Kinds of Agricultural Production, and Abundant Varietal Resources

Jiangsu Province straddles three biological and climatic zones, providing favorable conditions for the introduction from the north and from the south of plants and animals. Because of propagation and domestication by the working people over a long period of time, and the adaptation of general methods to local situations in farming and raising of livestock, agriceltural production is very diverse, and variety resources extraordinarily abundant.

Major agricultural crops grown throughout the province total more than 40 varieties. Paddy rice includes early, intermediate, and late ripening, and xian, geng, and glutinous varieties. At the present time, more than 60 superior varieties of rice are being grown over wide areas. Wheat and barley varieties include wheat, barley and naked barley, as well as winter and spring varieties. Cotton: Continental cotton varieties predominate, but under certain conditions island cotton types can also be introduced and domesticated or used as parent materials for the breeding of superior hybrid varieties. Oil-bearing crops include rape, peanuts, and sesame. Rape varieties includes those that are sown in the fall and those that are sown in the spring, both

wild cabbage variety and Chinese cabbage variety. Sugar crops include sugarbeets grown in northern Jiangsu, and sugarcane grown in southern Jiangsu.

Forestry output includes coniferous, broadleafed deciduous, and broadleafed evergreen trees. Moso bamboo, Japanese timber bamboo and henon bamboo all grow. There are both deciduous and evergreen fruit trees. Various other economic woods, woody grains, woody oil-bearing plants, types and varieties are also fairly numerous.

Livestock industry. There is a full array of large and small livestock and poultry including both northern and southern types. Hog varieties are particularly numerous, making Jiangsu the most complex region in the country in terms of hog production. There are six main varieties including Huai hogs, jiangquhai hogs, lake hogs, erhualian, dongchuan, and dahualian hogs. Cattle include water buffalo and oxen. There are both sheep and goats, han [1383] sheep being found mostly in the Xuzhou area, and hu [3275] being mostly found in the Lake Tai area. Goats are found throughout the province. The major local superior varieties of poultry include langshan [3708 1472] chickens, luyuan [7773 5373] chickens, liyang [2698 7122] chickens, loumen [1236 7024] ducks, gaoyou [7555 6755] ducks, haian [3189 1344] ducks, and Lake Tai geese.

Aquatic Products: Inland are vast river, lake, reservoir and pond water surfaces where aquatic products may be bred and caught. They contain more than 50 varieties of fish, of which more than 20 are major economic fish. In addition, in the Yellow Sea to the east where the cold and warm currents meet are vast fishing grounds. There are more than 40 different kinds of marine fish, shrimp, carbs, and scallops there.

Additionally, wild plant resources that the province provides or that have development prospects are very abundant, totaling more than 500 kinds. Though there are few wild animal resources, some may be introduced for domestication. The successful raising of mink is an example. Therefore, full use of the province's transitional position between natural zones for further expansion of the introduction of new species for breeding holds great prospects.

2. Farming Paramount in the Structure of Agricultural Production, Forestry and the Aquatic Products Industry Weak

Farming accounts for the largest proportion of the agricultural production sector. It accounts for 85 percent of the land area used for agriculture, and more than 85 percent of the agricultural workforce is concentrated in this sector. In total agricultural output value too, it also accounts for an extremely large proportion. Despite different degrees of development of forestry, animal husbandry, sideline occupations, and the fishing industry in recent years, which have caused a slight decline in the relative proportion of farming, in 1975, it was still 73.5 percent. Next was animal husbandry accounting for 14.2 percent of output value. After that was sideline occupations which, as a result of the development of comprehensive use of agricultural byproducts and the increase in commune and brigade enterprises, showed an obvious increase in proportional output value. It rose from 4.7 percent in 1965 to 9.3 percent in 1975. Forestry and the fishing industry are feeble by

comparison, their proportional output values being only 1.0 and 2.0 percent respectively, with little change for many years.

Within the farming industry, the grain crop growing area occupies the greatest proportion of the area devoted to the growing of all kinds of crops. In recent years, the multiple cropping area has steadily risen, but because of increases in the economic crop area, particularly the substantial expansion in the growing of green manure crops, the proportional area devoted to the growing of grain has gradually declined relative to the total crop growing area. In 1975, the total crop growing area was 131.38 million mu of which 72.8 percent was devoted to grain crops, 6.7 percent to cotton, 2.6 percent to oil-bearing crops, 15.8 percent to green manure, and 2.1 percent to other crops.

3. Farming System Complex; Multiple Cropping Index Fairly High

Because water and heat conditions differ within the province from north to south, and because there are fairly great differences in kinds of soil, farming methods are varied; consequently the farming system is complex and diverse, there being more than 30 different methods. Crop rotation and multiple cropping of wetlands is fairly straightforward. Mostly the system is one of a single crop of rice, with either wheat, barley, or naked barley, and either rape or green manure in a double cropping system each year, or two crops of rice plus either wheat, barley or naked barley, rape or green manure, in a triple cropping system each year. Some places practice a triple cropping system of two dryland crops and one wetland crop. Cotton growing areas practice rotational cropping of rice and cotton. Marshy areas grow mat rushes, arrowhead, and water chestnuts in multiple cropping. Dryland crop rotation and multiple cropping systems are extremely complex. In dryland grain growing areas, the growing of corn, soybeans, sweet potatoes and peanuts is divided between the spring and the summer. Crops maturing in summer include wheat, barley, and naked barley plus two different pulse crops in the rotational multiple cropping of two crops in 1 year or three crops in 2 years. Some places insert a late fall crop such as carrots for five crops every 2 years or seven crops every 3 years etc. In areas that grow both cotton and grain, more cotton is grown than wheat, barley or naked barley, and broad beans, peas, and green manure are intercropped etc. Companion cropping consists primarily of the companion cropping of wheat, barley, or naked barley with cotton; cotton with green manure; wheat, barley, or naked barley with spring sown corn, soybeans, or peanuts, and companion cropping of late autumn crops with green manure, etc. As a result of the promotion of green manure year round and the transplanting of animal fodder crops in recent years, all jurisdictions have invented numerous new intercropping and companion cropping methods.

Following Liberation, and most particularly since the 1970's, as a result of improvements in farmland water and soil conditions, the selection for use of early ripening bumper harvest varieties, the propagation of seedlings for transplanting, two stage seedling propagation, and other intercropping and companion cropping techniques, the multiple cropping index has risen with each passing year, an increase occurring in every prefecture in the province. The average multiple cropping index for the province was 158 percent in 1965; in 1975, it was 200 percent.

Table 3-1 Multiple Cropping Index in Various Prefectures of Jiangsu Province (1975)

Prefecture	Multiple Cropping Index (%)	Prefecture	Multiple Cropping Index (%)
Xuzhou Prefecture	163	Nantong Prefecture	218
Huaiyin Prefecture	194	Zhenjiang Prefecture	226
Yancheng Prefecture	200	Suzhou Prefecture	246
Yangzhou Prefecture	209	Nanjing City	206

4. Practice of Intensive Farming and High Degree of Intensivity

In Jiangsu Province, population is large relative to cultivated land, and workforce resources are rather copious for the practice of intensive farming. In recent year technical facilities for agricultural production have increased substantially; consequently, the degree of intensivity in agriculture is fairly high.

For every member of the agricultural population in the province, there is an average of 1.4 mu of cultivated land, and every member of the workforce farms an average of only 3.5 mu. Figured in terms of communes, for every member of the agricultural population in the province, there is an average of less than 1 mu of cultivated land for 22.2 percent. Those having an average of 1.0 to 1.5 mu number 40.5 percent; those with 1.5 to 2.0 mu number 28.1 percent; those with 2.0 to 2.5 mu number 7.5 percent; and those with more than 2.5 mu number only 1.7 percent. Consequently, a substantial number of workers may be used in agricultural production. In 1975, the workforce used averaged more than 110 work days per mu of cultivated land in the province.

In 1975, total agricultural machine power for the province amounted to 7.36 million horsepower, or an average of 10.4 horsepower per mu of cultivated land. Rural use of electricity amounted to 1.5 billion kilowatt hours. Quantity of chemical fertilizer used for agriculture was 1.49 million tons, or an average of 42.3 jin per mu of cultivated land.

Table 3-2 All Prefectures in Jiangsu Province

Amount of Work, Amount of Machine Power, and Amount of Fertilizer Used Per Unit of Cultivated Land (1975)

Prefecture	Amount of Work Work Days/Mu	Amount of Machine Power Horsepower/100 Mu	Amount of Chemical Fertilizer Jin/Mu
Xuzhou Prefecture	83	8.1	28
Huaiyin Prefecture	89	6.3	25
Yancheng Prefecture	88	7.6	36
Yangzhou Prefecture	124	12.4	41
Nantong Prefecture	129	9.5	45
Zhenjiang Prefecture	123	13.7	61
Suzhou Prefecture	161	15.7	78
Nanjing City	133	19.6	55
Provincial Average	110	10.4	42

Looked at in terms of degree of intensivity between one region and another, a difference exists within the province, intensivity being highest in the Lake Tai and seacoastal plain areas, second highest in the hill country in southern Jiangsu and on the Huainan Plain, and lowest on the Huaibei Plain.

5. Fairly Rapid Increase in Agricultural Production Levels and Fairly High Commodity Rate

Following Liberation, agricultural production levels in the province steadily rose, and during the past 10 years, in particular, the rise has been rather fast. Development has also taken place in commodity type agricultural production. The commodity rate is fairly high, and commodity bases for major agricultural products have gradually consolidated and expanded.

Grain Output: In 1975, the province's grain output totaled 38.7 billion jin, a 1.6 fold increase over 1949, an 81.2 percent increase over 1957, and a 44.5 percent increase over 1965. Yields per unit of area also steadily rose. As of 1975, the province had had 5 consecutive years of achieving "National Program" targets, and 52 of the province's counties (or municipalities) exceeded the "National Program" targets. Commodity grain totaled 8.56 billion jin, and the commodity rate was 22.6 percent. In 1965, the province stood in ninth place in terms of quantity of grain surrendered to the state, but had vaulted to first place by 1974. The Tai Lake region is the province's most important consistently high yield commodity grain base. Second comes the Zhenyang hill region and the Lixia He region. These old commodity grain bases have steadily consolidated and improved. During the past 10 years, the former low yield, grain short Xu-Huai region more than doubled its grain output to become virtually self-sufficient by 1973. It is now in process of gradually becoming a new commodity grain base.

Cotton Output: In 1975, cotton output totaled 9.06 million dan, a 15.1 percent increase over 1949, a twofold increase over 1957, and a 71.5 percent increase over 1965. Five prefectures and 22 counties (or municipalities) in the province reached the targets set by the "National Program." Jiangsu Province is one of the major cotton growing bases in the country, its output occupying second place in the country. Regions along the Chang Jiang and along the seacoast are the province's major cotton production bases, accounting for more than two-thirds of the province's total cotton output. In recent years, increase has also taken place in the ratio of cotton output and cotton procurement by the Xu-Huai region.

Hog Output: In 1975, the province raised 33.35 million hogs, or an average 0.5 head per mu of cultivated land. At the end of the year, those in inventory numbered 19.97 million, a 3.8 fold increase over 1949, a 1.4 fold increase over 1957, and a 63.3 percent increase over 1965. Five prefectures and 42 counties (or municipalities) achieved the targets of the "Natonal Program." Jiangsu Province stands second in the country in terms of number of hogs in inventory; it stands in first position in numbers shipped elsewhere. Raising of domestic fowl is everywhere common; consequently, on some years, the province stands first in the country in quantities of fresh eggs supplied the state.

In addition, increases have taken place in both the output and commodity rate of aquatic products, silkworm cocoons, fruits, and teas, and commodity bases for these products have steadily consolidated and developed.

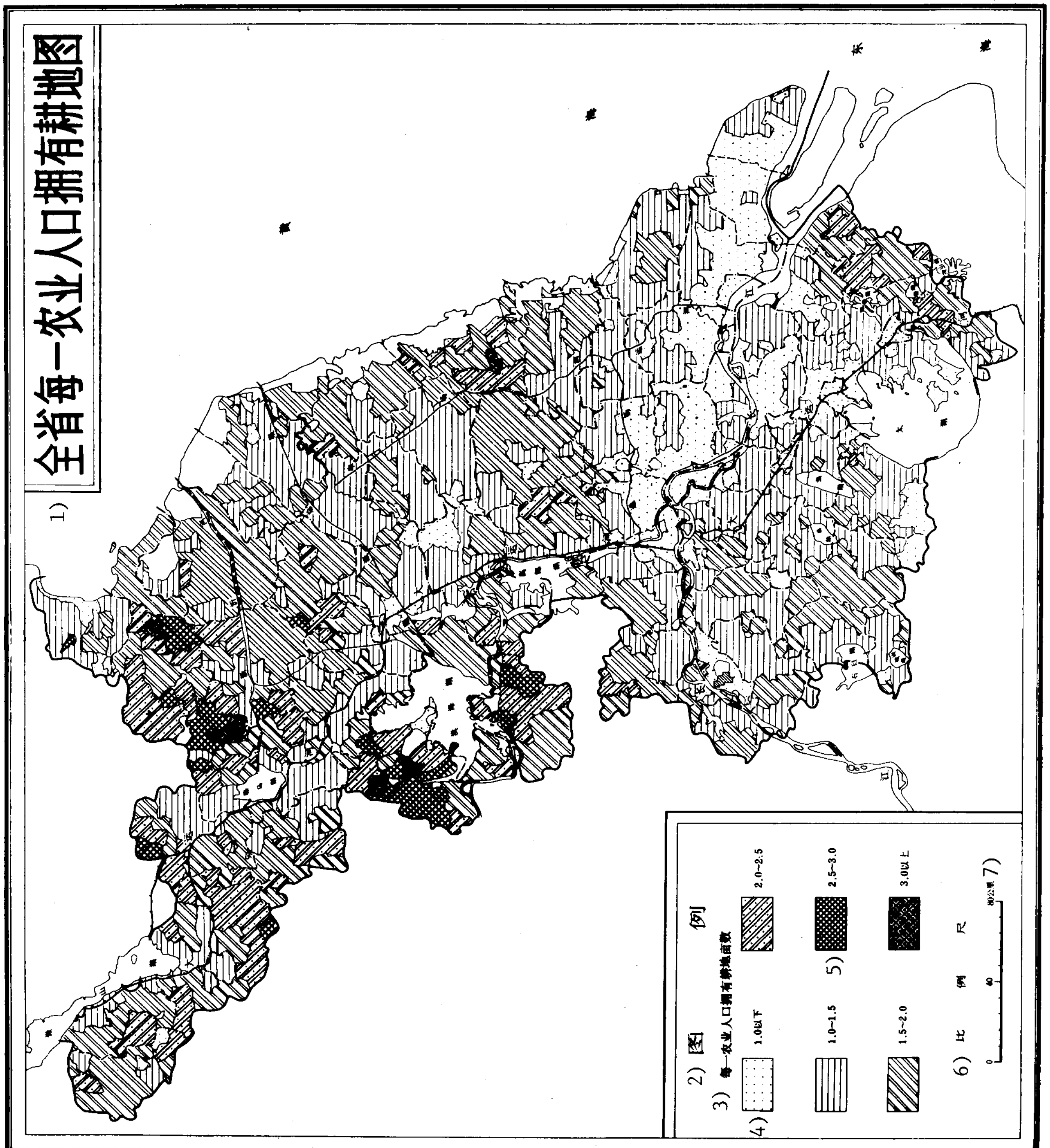
Second Section. Pattern of Agricultural Production

1. Grain Crops

In 1975, the province's grain crop growing area was 95.67 million mu. In terms of total grain output, the proportion of autumn grain is far greater than summer grain, autumn grain accounting for 74.5 percent and summer grain accounting for 25.5 percent of the total. Paddy rice holds first place, and has steadily risen in proportion over the years. In 1975, it accounted for 59 percent of grain. Wheat, barley, and naked barley were second and had slightly declined over the years, accounting for 26 percent of the total in 1975. The proportion of food grains other than wheat and rice showed substantial decline over the years, accounting for only 15 percent of total grain output in 1975.

Table 3-3. Proportional Changes in Output of Rice, Wheat, Barley and Naked Barley, and Grains Other Than Rice and Wheat in Total Grain Output

Year	Total Grain Output (100 Million Jin)	Rice (%)	Wheat, Barley & Naked Barley (%)	Grains Other Than Rice & Wheat (%)
1949	149.7	42	29	29
1965	267.8	55	24	21
1975	387.0	59	26	15



1. Cultivated Land Per Capita of Agricultural Population in Jiangsu Province
2. Legend
3. Number of Mu of Cultivated Land Per Capita of Agricultural Population
4. Less than 1.0
5. More than 3.0
6. Scale
7. Kilometers
8. Figure 15

Rice culture has a long history of Jiangsu Province, and in recent years a steady expansion has occurred in its area of distribution. In 1975 the rice growing area was 44.56 million mu or 34 percent of the total area sown. Rice culture had formerly been concentrated in the Lake Tai area and on the Lixia He Plain, the Zhenyang hills and lowland areas along the Chang Jiang also being major growing areas. Little was grown north of the Huai. Beginning in 1956, the area north of the Huai began a gradual conversion of drylands to wetlands, and by 1975, the converted area totaled almost 8 million mu or 18 percent of the paddy fields in the province for the gradual formation of a new rice growing area. Today most communes and brigades grow rice to a greater or lesser degree, but it is in the mottled alkaline land and in lowland silt soil areas where water resources are fairly well assured that rice growing is mostly concentrated with rather good result. In the Tongyang high sandy soil region north of the Chang Jiang, production of dryland grains formerly predominated. In recent years, however, conversion of drylands to wetlands has been carried out, and today the paddy field area amounts to about 20 percent of the cultivated land area. Following improvements in water conservancy conditions, some of the former drylands on hill slopes in the Zhenyang hill region that "had looked to the heavens for water" were also converted to the growing of paddy rice.

In the wake of improvements in water and fertilizer conditions and improvements and innovations in farming techniques, the pattern of rice varieties has undergone corresponding changes. The overall situation in the province is as follows:

Little single crop early rice is presently grown. Single crop intermediate rice amounted to 47 percent of the total rice field area in 1975 as a result of its expanded cultivation north of the Huai following conversion of drylands to wetlands. Intermediate maturing xian accounts for slightly more than intermediate geng. As a result of the conversion from a single crop to a double crop, a great reduction occurred in the amount of single crop late rice planted; in 1975, it accounted to 21 percent of the total rice growing area in the province. In recent years double crops of rice have developed rapidly. The after crop rice growing area in a double rice crop system now accounts for 32 percent of the total ricefield area in the province.

In the Lake Tai region, more than 75 percent of the ricefield area grows two crops of rice; in the hill region to the south of the Chang Jiang, it is almost 50 percent; in the area between the Chang Jiang and the Huai it is about 10 to 30 percent; and north of the Huai only a small amount of test planting has been done. Given the state of varieties currently available and planting techniques, heat conditions for the growing of two crops of rice are pretty well assured south of the Chang Jiang. In the area between the Chang Jiang and the Huai, though the season is somewhat short, it is not a major limiting factor; it is simply necessary on the basis of available local workforces and fertilizer to adapt general methods to local situations to make suitable plans about proportions and combinations of varieties. At the present time, mostly xian rice is grown in the early season. Its quality is not as good as that of geng rice, and its yield of polished rice is lower. Better varieties to replace it should be bred.

In 1976, successful test plantings of hybrid rice were conducted in numerous pilot projects in the province, and a substantial potential exists for increased yields. Expansion of the planting of hybrids is a new way in which greater output of rice can be attained.

Wheat, barley, and naked barley are the province's major summer grain crops. In 1975, they were grown over a 31.53 million mu area, or 24 percent of the total area sown to crops. They are grown throughout the province except for a small number of lake lowland areas and in severely salinated soil along the seacoast. At the present time the ratio of the wheat growing area to the barley growing area is about 3:2. Formerly barley and naked barley were grown mostly in cotton growing areas along the seacoast and along the Chang Jiang, the barley being intercropped with cotton as an early sown crop. In recent years, following development of a three crop system of wheat, barley or naked barley - rice - rice, wheat growing has been curtailed so that rice may be sown early, and the amount of barley and naked barley grown has been increased. Increase in the growing of early ripening high yield barley varieites has been especially great. Food quality of barley and naked barley is rather poor, and these grains are also poor as commodities. In addition, prices paid for them are less than for wheat. Therefore, it is necessary to breed exceptionally early ripening wheat varieties to replace barley and naked barley. As a result of the adoption by wheat growing areas of cotton seedling propagation and transplanting, the trend has been to an expansion in the proportion of wheat grown.

The soybean growing area formerly accounted for somewhat more than six percent of the total area sown to crops, and was concentrated largely north of the Huai, the high sandy soil areas north of the Chang Jiang being second. Some was also grown in cotton growing areas along the Chang Jiang and along the seacoast, in the drylands of the Zhenyang hill region, in the Meng He area around Lake Tai, and in the Taoge high plain area. In recent years, since per unit yields of soybeans have not been high, they have frequently been replaced by other high yield crops and the area on which they were grown has been cut in half. In 1975 the growing area was 4.22 million mu, amounting to only three percent of the province's total crop growing area. Soybeans are high in nutrients, have wide uses, and help nurture the soil. Suitable arrangements must be made to grow them, and major growing areas should not continue to cut back on their cultivation. At the same time it is also necessary to intensify the breeding of high yield superior varieties and to improve cultivation and care for active increase in yields per unit of area.

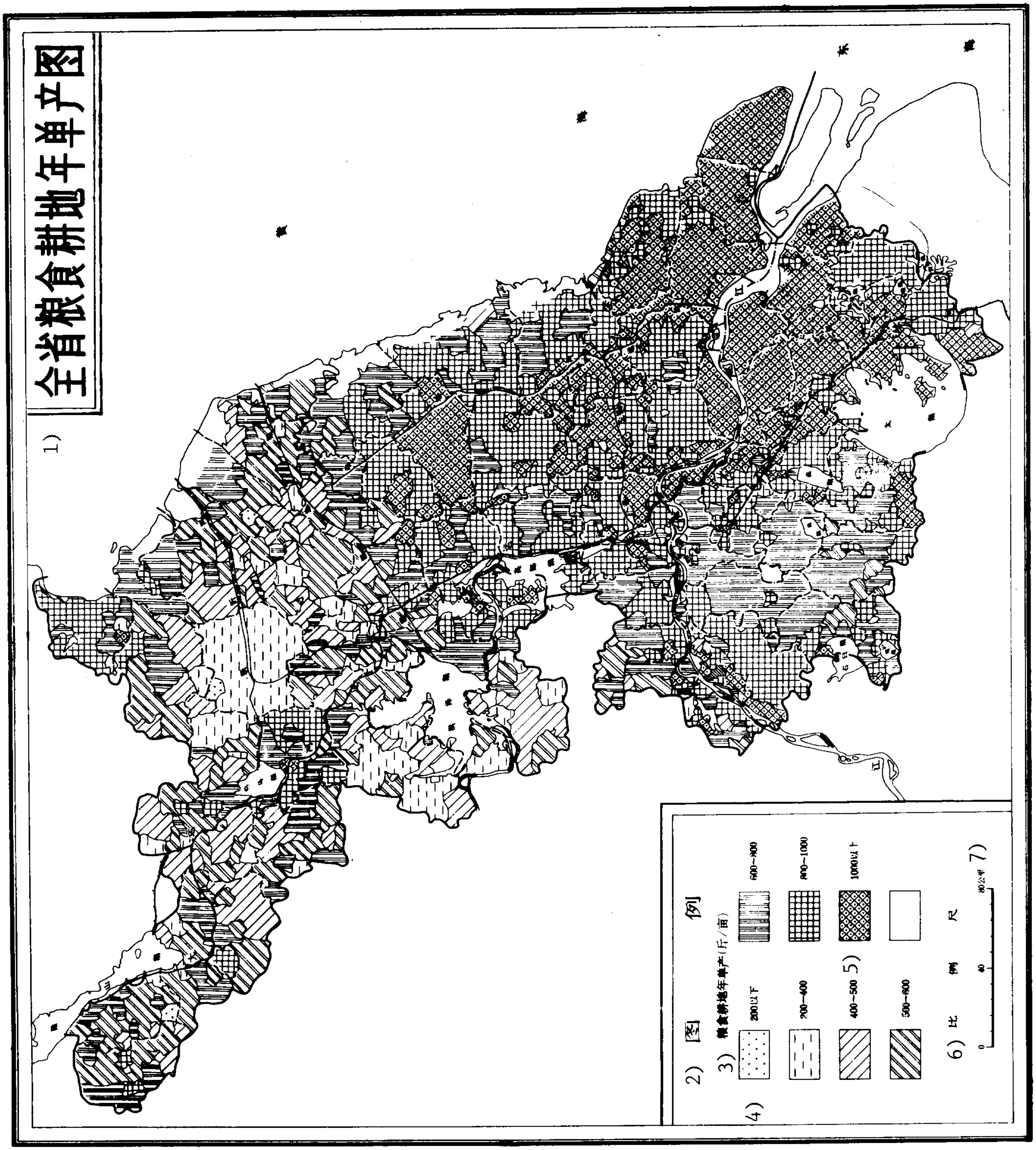
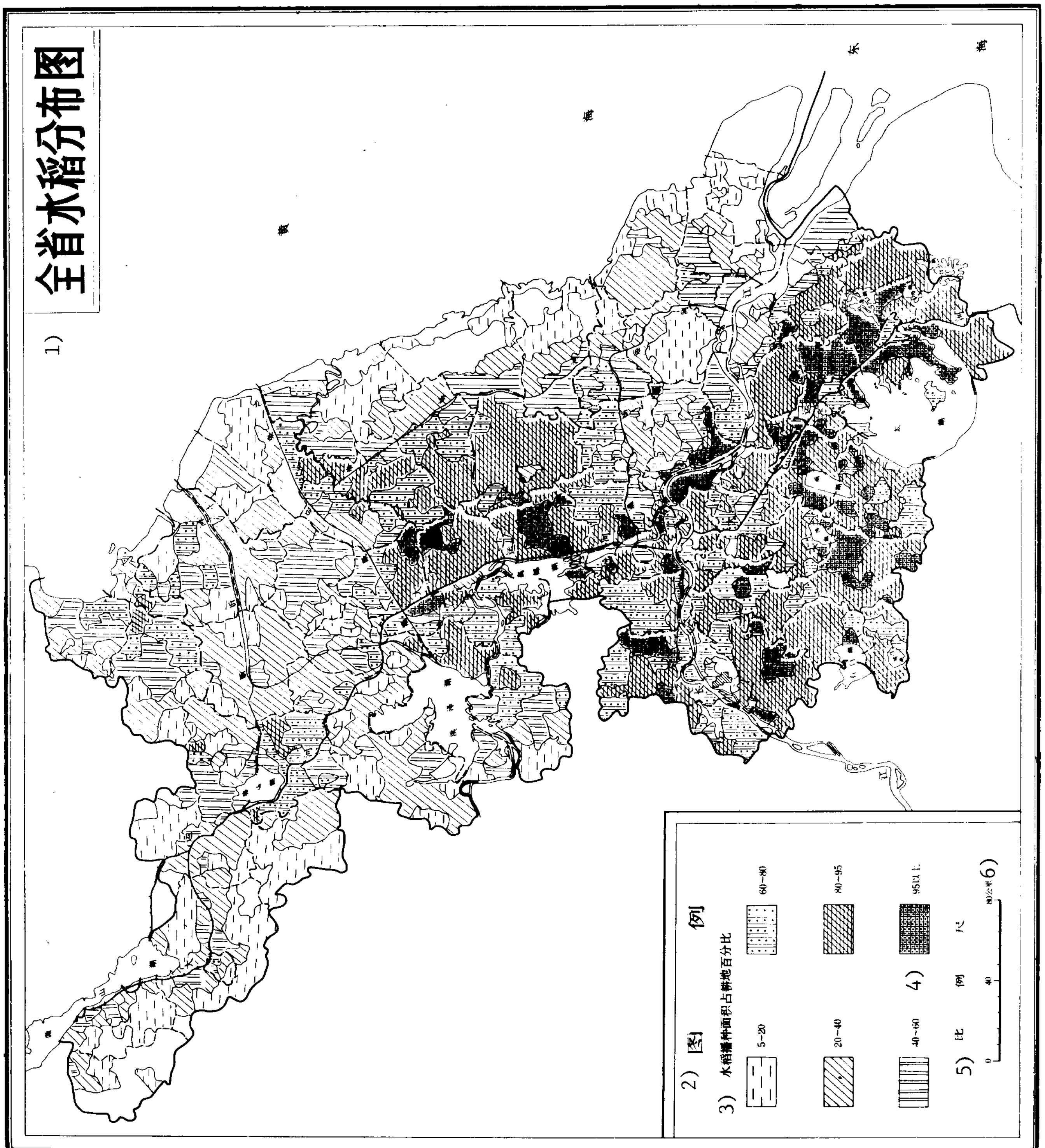
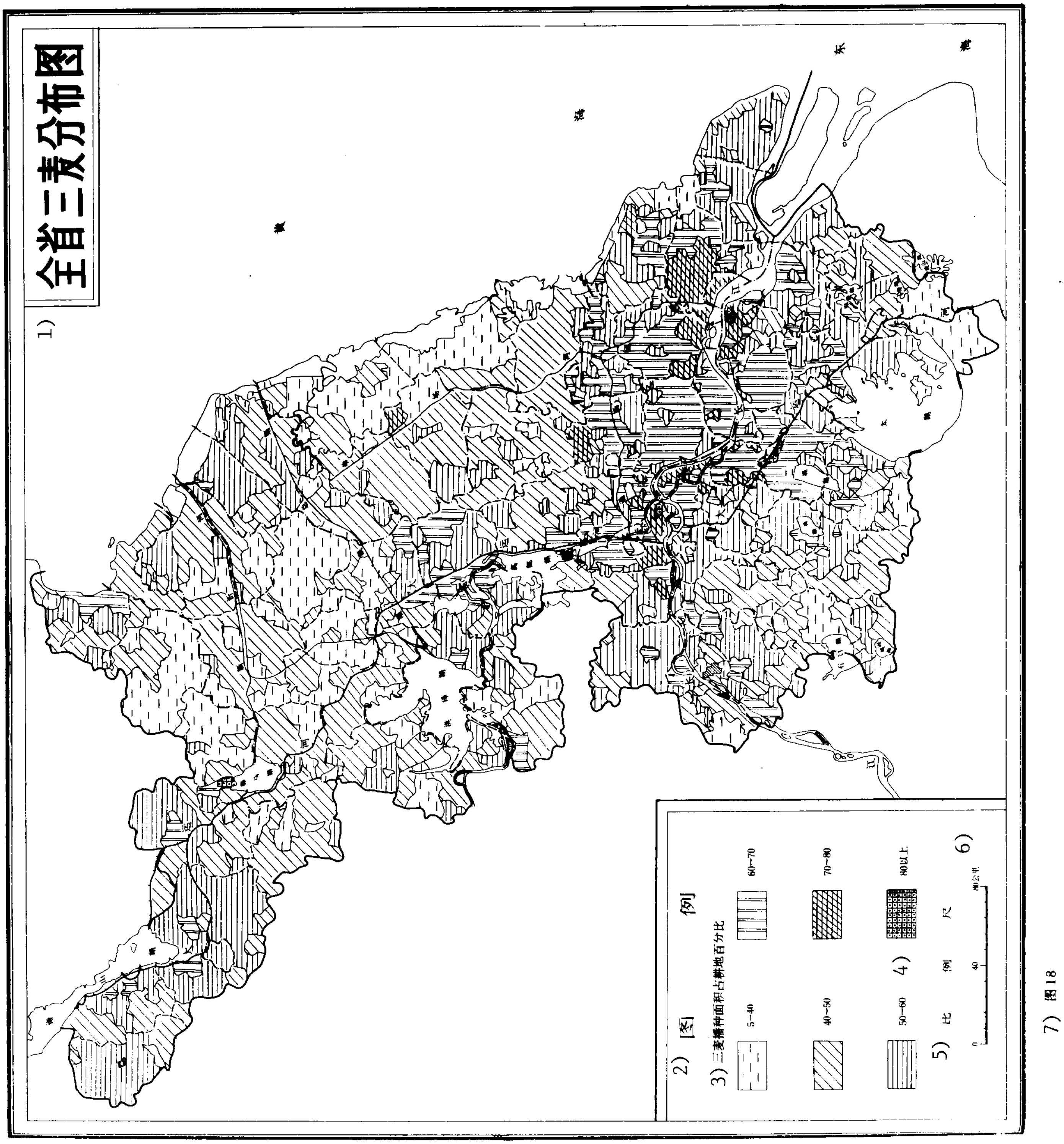


Figure 16

1. Province's Annual Grain Yields Per Unit of Cultivated Land
2. Legend
3. Annual Grain Yields Per Unit of Cultivated Land (Jin/Mu)
4. Less than 300
5. More than 1,000 6. Scale 7. Kilometers



1. Distribution of Paddy Rice in Province
2. Legend
3. Rice Growing Area as a Percentage of Cultivated Land Area
4. More than 95
5. Scale
6. Kilometers
7. Figure 17



1. Distribution of Wheat, Barley, and Naked Barley in Province
2. Legend
3. Area Sown to Wheat, Barley, and Naked Barley as a Percentage of Total Cultivated Area
4. More than 80
5. Legend
6. Kilometers
7. Figure 18

2. Economic Crops

Jiangsu Province has a profusion of economic crops including those used for fiber, for oils, for sugar, for drinks, for pharmaceuticals, and for special purposes. In 1975, the area devoted to economic crops totaled 13.03 million mu. The principal economic crop was cotton; second was rape and peanuts; next was various kinds of hemp of which jute and ambari hemp were most important; and finally was peppermint, sugarbeets, tobacco, medicinal materials, and mat rushes. Distribution in the province of major economic crop production areas is relatively concentrated, and possesses significance in regional division of labor.

The growing of cotton in Jiangsu Province has a very long history, but before Liberation, yields per mu were extremely low. Following Liberation, growth was very rapid. In 1955, the cotton growing area totaled 9.99 million mu and yields averaged 39 jin per mu. Subsequently, as a result of increases in the level of grain self-sufficiency, the cotton growing area shrank, but both yields per unit of area and total output steadily advanced. In 1975, 8.8 million mu of cotton were grown in the province, and yields had increased to an average 103 jin per mu. Daizi variety cotton remained most common.

The kinds of cotton field cultivation may be generally divided as follows: (1) Cotton, dryland grain and wheat, barley or naked barley, and green manure in a double cropping system, the main area of distribution being along the seacoast in the mixed grain and cotton growing region. (2) Rice, cotton and wheat, barley or naked barley, and green maure in a double cropping system, the main areas of distribution being the flatland fields along the Chang Jiang in the east, the Lixia He region, and some sections of the Zhenyang hill region. (3) Cotton, special economic crops and wheat, barley or naked barley, and green manure in a double cropping system, the main area of distribution being in Nantong and coastal areas. (4) Cotton and wheat in a double cropping system, done in some communes and brigades in the northeastern part of Changshu County and in the high sandy soil area along the Chang Jiang. (5) A single crop of cotton, the area of distribution being in the mottled alkaline soil north of the Huai and in heavily saline sections along the seacoast. Formerly the ground lay fallow in winter, but now much winter green manure is grown. Formerly the two types predominated throughout the province.

In recent years, some new readjustments and changes have been made in the pattern of cotton growing, the general situation being an expansion from east to west of cotton fields. In the Xu-Huai cotton growing area, the long period of sunshine and scant autumn rains favor the blossoming, boll formation, and splitting of bolls for an increase in earnings. As a result, cotton fields have increased by more than 15 percent since 1965, and a high yield cotton region covering a large area has come into being. In the area between the Chang Jiang and the Huai, changes in the cotton growing pattern have been most remarkable. On the plain of the Lixia He waterway network, formerly only those communes and brigades near the Fangong embankment practiced crop rotation using rice, wheat, cotton, and green manure, but now it has spread westward to become the dominant farming system in the whole region. The cottonfield area has spread to Gaoyou, Baoying, and Jinhu counties, which formerly grew any

cotton. Cotton has also spread to the gently rolling hills of Yicheng, Liuhe, and Xuchi in the hilly region north of the Chang Jiang. In the old cotton growing areas along the Chang Jiang and along the seacoast, because of an expansion of the growing of paddy rice, and particularly following development of a double and triple cropping system, a struggle has taken place between grain and cotton for available manpower and fertilizer. Cultivation and care of cotton has been let slide and less fertilizer has been given cotton. This has hurt increases in cotton output, and consequently a contraction of the cottonfield area has occurred. Though these readjustments ameliorate the conflict between grain and cotton and have played a role in increasing earnings in grain growing areas, they have hurt the adaptation of general methods to local situations, proper concentration, and the gradual practice of specialized production.

Some of the newly developed cotton growing counties also have different ways of dealing with their cottonfields. In some counties where planned distribution of cotton fields is extremely small, emphasis is placed on the sensible rotation of wetland and dryland crops, and cottonfields are fairly concentrated in certain communes and brigades. In some counties, though the planned cotton fields are relatively numerous, because of the principle of sowing the right crop in the right soil, great differences exist in the allocation of duties to communes and brigades, and in the adaptation of general methods to local situations. In some other counties, on the other hand, emphasis is given to concern for economic benefits, and frequently cotton growing is shared among communes and brigades on the basis of their average number of mu of cultivated land. In order to increase cotton output, a suitable distribution of cotton growing within a concentrated area is best. This is because average distribution not only is not helpful to rational rotation of wetland and dryland crops, but is also disadvantageous to improvement in cotton growing techniques and in yields per unit of area. Moreover, it is also disadvantageous for centralized procurement, and for reducing mongrelization of cotton seeds at the time of ginning to avoid regression.

Oil-bearing crops, mainly in the form of rape and peanuts, ordinarily provide the province with about 50 percent of its edible vegetable oil. Oil is also pressed from some soybeans and cottonseeds as a major supplement to edible oil. The area sown to other oil-bearing crops, such as sesame and sunflowers, is very small, and occupies no important position. Jiangsu Province was once the major peanut producing area in the country, but the area sown is very inconsistent and in recent years, as a result of changes in the farming system from drylands to wetlands and the emphasis on grain to the neglect of oil-bearing crops, a marked decline has taken place in the growing of peanuts. In 1965, they accounted for 58 percent of the total area devoted to oil-bearing crops, but by 1975, they accounted for only 32 percent. The reverse has been true for rape, which has kept pace with rice development. The 1975 rape area had more than doubled over what it had been in 1965, and now accounts for 65 percent of the area devoted to oil-bearing crops.

Within the province, 60 percent of all peanut growing is concentrated in the area north of the Huai. The proportion is greatest in the pebbly hills in the northeastern part of the region north of the Huai where a slight increase in area has occurred since 1965, amounting to about 35 percent of the total.

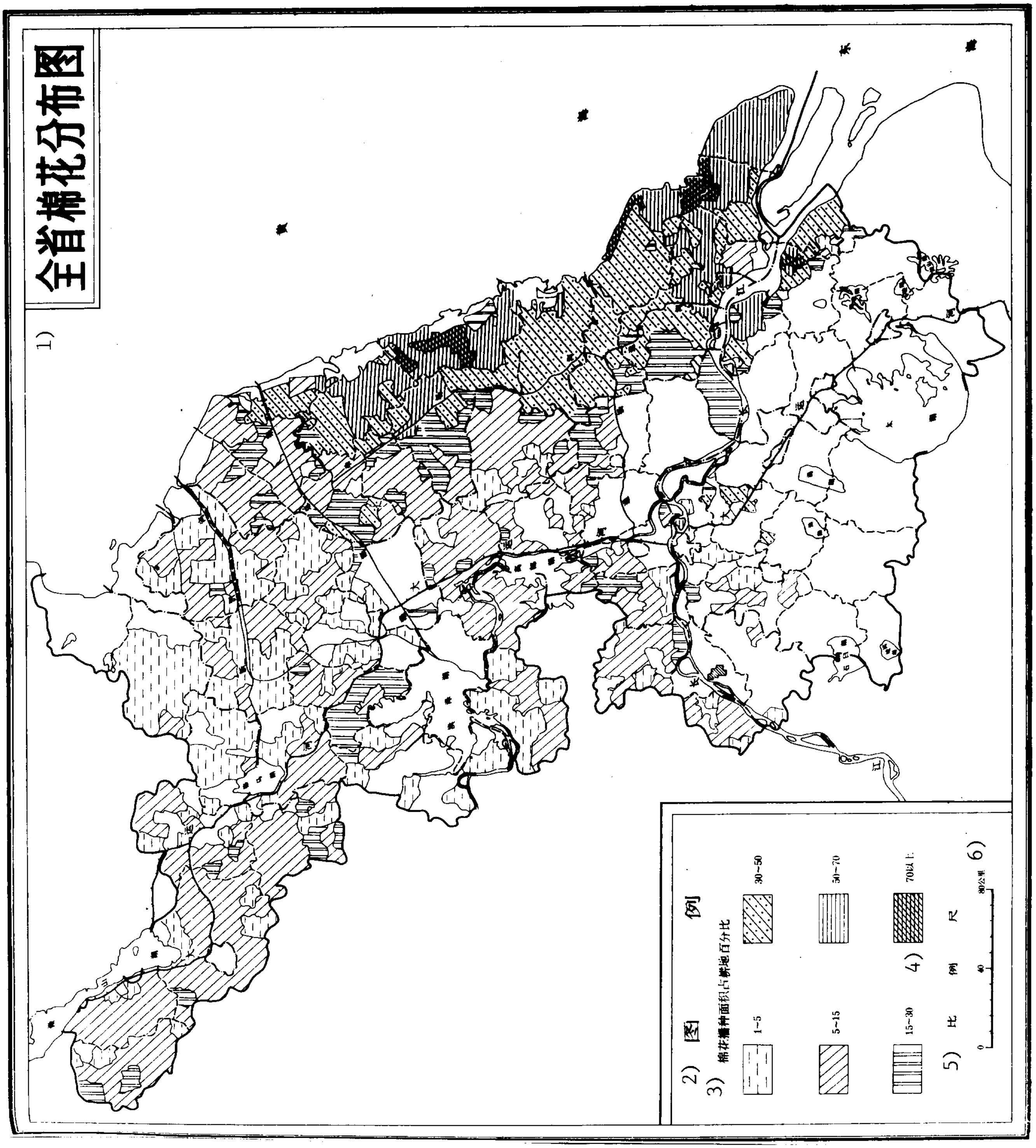
Mostly it consists of a single crop of spring peanuts each year, from which yields per unit of area are fairly high. Second in importance is the sandy plain in the western part of the area north of the Huai and the high sandy soil region along the Chang Jiang where peanuts are interplanted with wheat for the most part. In recent years the growing area has become generally less. In future, there should be a planned, appropriate revival of the growing of peanuts, and efforts made to increase yields per unit of area. Rape was formerly concentrated in the paddy rice growing areas south of the Chang Jiang. In the Lixia He region, it was formerly grown only in the haystack fields of Xinghua County. Following the transformation of waterlogged fields to drylands, the area multiply cropped to rape increased five fold. The Xu-Huai region formerly grew no rape, but its growth has spread in accompaniment to the increased growing of rice. However, winter damage is fairly severe to rape sown in winter in the Xu-Huai region to the impairment of output. In recent years success has been won in test plantings of spring sown rape.

In 1975, various kinds of hemp were grown on 360,000 mu in the province. Hemp included jute, amberi hemp, ordinary hemp, ramie, and flax. Jute and amberi hemp predominated. Jute is distributed mostly in Nantong, Haimen, and Jiangdu counties to the south of the Chang Jiang and hold a definite place nationally. Amberi hemp is found in the western part of the Xu-Huai region in Shuyang, Pi, Suining, and Sihong counties. The area has doubled during the past 10 years, but farming is slapdash, and output is not high.

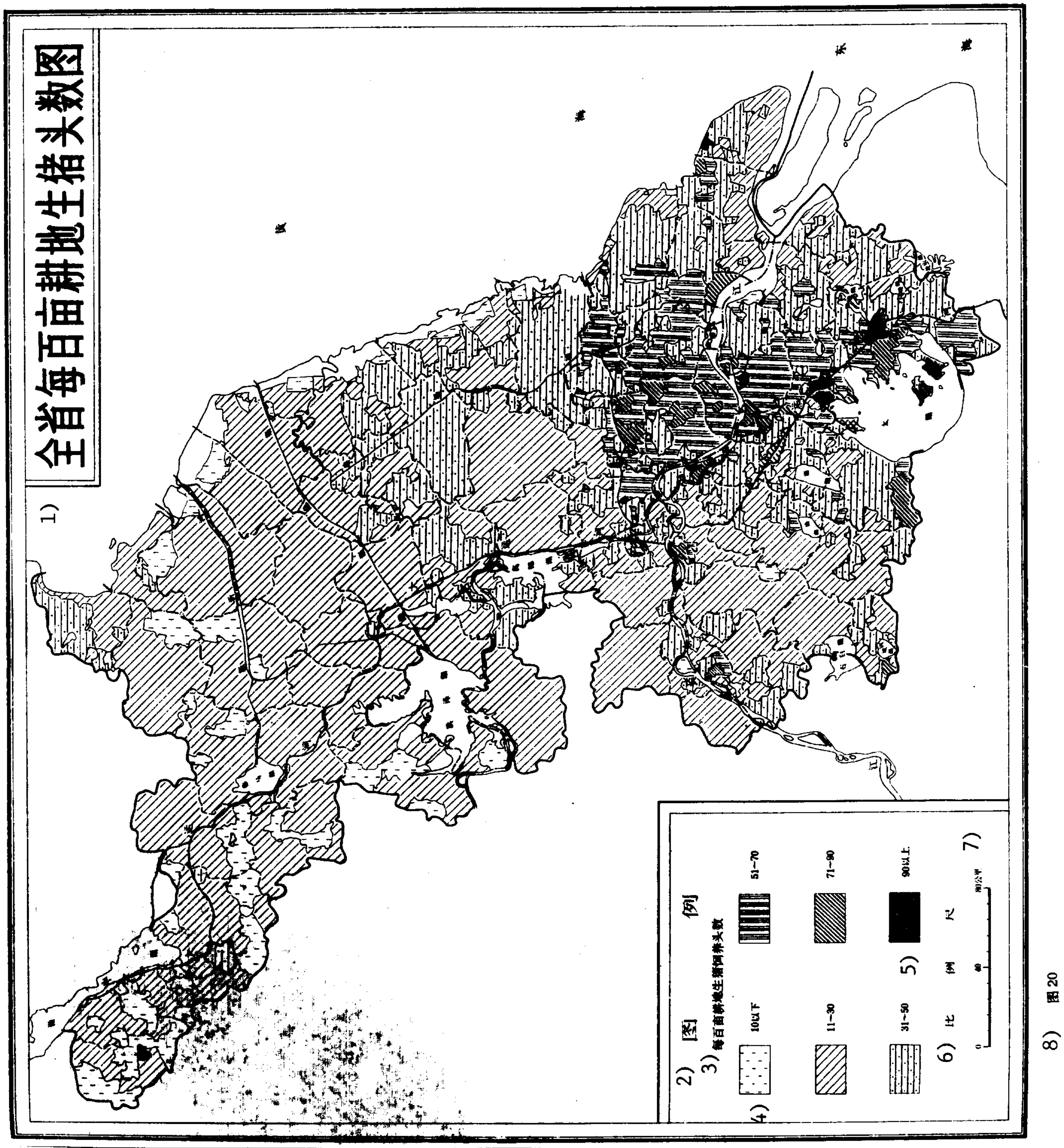
In 1975 the province grew 96,000 mu of sugar crops. Jiangsu Province formerly grew no sugar, but since it was needed in the people's lives, once test plantings succeeded, its cultivation expanded rapidly. Coastal counties and Huaiyin county have developed sugarbeets and set up sugar refineries. Sugarcane is grown south of the Chang Jiang in Jintan, Gaochun and Yixing counties, and at numerous places in the suburbs of Nanjing. The growing area is only one-tenth that of sugarbeets, and sugar content is not high because of limited heat conditions. Sugarbeets are readily grown in the province, but only with planning can there be further room for their development. In addition to existing sugarbeet growing areas devoting an area to them and implementing economic policies, the northern part of Nantong Prefecture along the Chang Jiang can promote a farming system of two grain crops and one sugar crop, i.e. wheat, barley or naked barley - corn or early rice - sugarbeets, for three crops in 1 year . In newly reclaimed beach areas along the seacoast, state farms specializing in the growing of sugarbeets can also be established as can sugar refineries to meet the province's ever increasing needs for sugar.

In 1975, the province grew 84,000 mu of flue-cured tobacco, the growing area being concentrated in the counties in the western part of the Xu-Huai region.

Additionally, special economic crops such as peppermint and spearmint have stabilized production in recent years at around 200,000 mu. These are famous products nationally, and output amounts to about 90 percent of the national total. They are grown in 10-odd communes in Nantong, Haimen, Taicang, and Shazhou counties along the Chang Jiang, where they are mostly rotationally cropped with jute, cotton, and corn. Recently there has been a gradual change from direct winter seeding of peppermint to transplanting during the summer, and a trend toward a single cutting instead of two cuttings with a change from a two crop system for peppermint to a triple cropping system of naked barley - peppermint - late rice. This will help improve quality and quantity of peppermint oil.



1. Distribution of Cotton in Jiangsu
2. Legend
3. Area Sown to Cotton as a Percentage of Cultivated Land
4. Less than 70
5. Scale
6. Kilometers
7. Figure 19



1. Number of Live Hogs Per 100 Mu of Cultivated Land in Jiangsu
2. Legend
3. Number of Live Hogs Raised Per 100 Mu of Cultivated Land
4. Less Than 10
5. More Than 90
6. Scale
7. Kilometers
8. Figure 20

3. Livestock

Livestock production in Jiangsu Province is closely associated with farming. It is extremely unspecialized, and farming and livestock raising play a role that is mutually dependent and mutually promoting. Kinds of livestock and poultry are legion. Hogs are the most common kind of domestic livestock, but there are also cattle, horses, donkeys, mules, goats, sheep, and rabbits. Domestic fowl include chickens, ducks, and geese, which are raised everywhere.

Hogs are commonly raised in rural villages throughout the province. In the Lake Tai region and along the Chang Jiang, where agricultural production levels are high, hog raising rests on a fairly good foundation. The number of head raised there is numerous sheds and stys account for 42 percent of the province's total. In some counties and communes the number per farming household averages more than four head, and those collectively raised average 36 percent of the total number raised, there being between 60 and 70 head per 100 mu of cultivated land. Numerous communes and brigades count one hog per mu or one hog per person. In the Xu-Huai region, hog raising is the major sideline occupation in rural villages, and this is also the principal live hog production base in the province. This region accounts for 17 percent of all hogs raised in the province, and there are about 25 head of hogs per 100 mu of cultivated land. In areas in which cotton growing is concentrated, fodder supplies are limited, so hog raising is generally less, only 10 to 20 head per 100 mu.

There are very many local varieties of hogs. Hui hogs are distributed mostly in northern Jiangsu, but some may be found in the Zhenyang hill region. They tolerate coarse food. Lake hogs are seen mostly south of the Chang Jiang. From their center around Lake Tai, they have spread to neighboring prefectures. Their bodies are small but chunky; their flesh is fine in texture, and they mature early. Jiangquhai hogs are found in the southern part of the Lixia He region and in the northern part of the high sandy soil area along the Chang Jiang. They grow fast, have high fecundity, have much lard and good meat, and are fine for making ham. Erhualian hogs are found mostly on both banks of the lower reaches of the Chang Jiang. They are medium build, grow relatively fast, and tolerate coarse feed. The area in which Dongchuan hogs and Dahualian hogs are found is very small. The former is limited to the area between Taixing and Rugao, and the latter are gradually dying out. The new Huai hog bred after Liberation is quite strongly adaptable, produces a fairly large number of shoats, fattens and gains weight fairly rapidly, and is being vigorously bred and promoted.

In future, in order to satisfy needs for meat and for organic fertilizer, there must be considerable development of hog raising enterprises. The key lies in increasing sources of hog feed. General methods must be adapted to local situations to set up feed bases, full use made of suitable crop rotation, major efforts made in intercropping and transplanting, and vigorous growing of aquatic feeds done in places that have water surfaces.

Oxen and water buffaloes are used mostly as draft animals and are found in substantially the same numbers in drylands and wetlands alike. Formerly oxen slightly outnumbered water buffalo. Oxen are concentrated mostly in the

drylands of the Xu-Huai region, and secondly in the high sandy soil region of Tongyang County. Water buffalo are fairly numerous in all counties in the Zhenyang hills along the Lixia He and in the northern area along the coast. In other places water buffalo are generally more numerous than oxen. However, following the conversion of drylands to wetlands, a commensurate increase occurred in the number of water buffalo while the number of head of oxen declined noticeably. As a result of the development of farm machine power, the lack of feed, and the fairly high cost of raising them, the number of cattle used for plowing has declined greatly in recent years, particularly in south Jiangsu and in lowland areas along the Chang Jiang. Today there are only 1 million draft animals in the province, an average of only one head per 70 to 80 mu of cultivated land. In terms of species, the great West Shandong ox of the area north of the Huai has a large body and strong pulling power. The Haizi water buffalo used along the seacoast has a large strong body. Both are good regional varieties of cattle. Both the barren mountains of the hilly region and the grassy shore along the seacoast have conditions for the establishment of cattle raising bases for breeding. Looked at in long range terms, future attention should be given development of cattle to provide meat and cattle to provide both meat and milk to meet the needs of cities and countryside for milk and meat.

Much growth has taken place during the past 10 years or more in the raising of sheep and goats. Goats have increased by 38 percent, and sheep have increased by 49 percent. In 1975, the province raised 5.02 million sheep and goats, 3.95 million goats and 1.07 million sheep. Goats are concentrated in the cotton growing areas along the seacoast and along the Chang Jiang. Quality is best in those from the area stretching from Qidong to Haimen. Sheep are found principally in the Xu-Huai and Lake Tai regions, and account for 80 percent of all sheep in the province. The quality of lambs wool from lake sheep from the Lake Tai region is good and its economic value rather high.

Poultry raising is the most common agricultural sideline occupation in the province. Chickens are raised in fairly large numbers in the Zhenyang hills, around Lake Tai, and in areas along the seacoast and along the Chang Jiang. Ducks and geese are found mostly in the marshy waterway-laced areas of the Lixia He and Lake Tai.

4. Forests, Mulberry, Tea, and Fruit

Jiangsu Province consists mostly of plains; low mountains and hills are extremely few. It is, in addition, agriculturally developed, so not only are natural forests extremely rare, but even fragmentary remnants of secondary forest growth are scarce. The foundation for an indigenous forest industry is extremely weak. Some improvement took place as the result of active efforts made following Liberation, but tree survival rates and preservation rates were overly low; thus the area that developed into forests was extremely slight; the proportion of mature forests was low; forestry resources were inadequate; and distribution was uneven, while building needs steadily increased. The supply of lumber, bamboo and tung oil is far from meeting demand, and the rate of self-sufficiency is very low. Jiangsu is the country's province most lacking in timber. However, during the past somewhat more than 20 years, substantial development has occurred in mulberry, tea, and fruits.

The afforested area of the province amounts to only 4.1 percent of the province's total land area, and among standing reserves mature forests account for only 4.3 percent of the total. Middle age forests account for 72 percent, and young forests account for 23.7 percent. Since the Great Cultural Revolution, great development has taken place in the afforestation of the four besides [beside roads, streams, villages, and houses]. A comparison of 1974 with 1964 shows a more than 11 fold increase in reserves amounting to 73.8 percent of total reserves. This has been a distinguishing feature of the province's forestry production.

Distribution of forest tracts generally follows distribution of mountains and hills. In both forested area and in tracts of timber reserves, the Zhenyang hill region holds first place, accounting for about 47 percent and 35 percent respectively of the province's totals. Second in importance is the Xu-Huai region where forested land amounts to 27 percent, most of it concentrated in the Yuntai Mountains and in the forested tracts in the limestone hills near Xuzhou. Afforestation of the four besides has been relatively greater on the plain to the north of the Huai and on the plain between the Chang Jiang and the Huai. Timber reserves in the Xu-Huai region account for 48 percent of the province's total. Shuyang County is already self-sufficient in timber for agricultural use.

Suitable for afforestation of the sunny slope of mountains and hills with a thick layer of soil are fast growing, fine lumber quality beeches of all kinds. Trees that grow slowly but also produce fine quality lumber are yellow sandalwoods and lindens. Able to grow on the dry slopes of limestone rock hills are various members of the elm family and oriental arborvitae, which make fine quality lumber that is solid. Suited to the somewhat shaded gentle slopes of the Zhenyang hills are Quercus glauca [a member of the oak family], Castanopsis sclerophylla [an evergreen], and Schima superba. Suitable for growing in the ravine-riven Yi and Li mountainlands are the broadleaf evergreens, qiashizhu [0595 3044 293A] [an evergreen oak] and Machilus thunbergii. These trees all produce high quality lumber. Deciduous trees include the famous golden larch, and nanmu [Phoebe nanmu], which can be used for the afforestation of sunny slopes where the soil layer is thick. Suitable for use in the afforestation of sunny slopes where the soil layer is thick. Suitable for use in the afforestation of flatlands laced with waterways are Chinese ash, metasequoia, and willow. Suitable for afforestation of the sandy wasteland of the old bed of the Huang He north of the Huai are Chinese white poplars, Jian poplars [0256 2799], De poplars [1795 2799], Populus simonii [Nanjing white poplar], and bailatiao [4101 5198 2742]. Suitable for growth in the saline soil region along the coast are black locust, chinaberry, and tree of heaven. In places where salinity is fairly severe, Chinese tamarisk may be grown.

During the past 10 years substantial development has occurred in bamboo forests and in bamboo forest reserves, the area having increased by about 40 percent. Eight percent of all moso bamboo forests are concentrated in southern Jiangsu, principally in the Yi and Li mountain areas, which are the province's principal bases. Shrubs such as salix sino-purpurea and false indigo, which are highly adaptable and produce high earnings, have also seen substantial development.

In recent years, vigorous efforts have been made in the spread of the three kinds of fir (China fir, cryptomeria, and metasequoia), and three kinds of bamboo (moso, gang, and dan bamboo), with remarkable successes. Fir grows very well in the hills of southern Jiangsu where tracts of fir forests already exist. In the Yuntai Mountains of northern Jiangsu and atop the dikes of the main irrigation canal in Funing, where a suitable microclimate exists and where partial improvement in water and soil conditions has been made, test plantings have been successful. Metasequoias, including pond cypress and larch, grow readily on the waterlaced plain of the Xiali He, and cryptomeria grows very well along the seacoast in Nantong. Both have prospects for development. The area of cultivation of the three bamboos has also steadily increased. Test plantings of moso bamboo in the eastern hills north of the Huai have been successful, and gang and dan bamboo can be developed on the Huaibei Plain.

Varying degrees of development have occurred in the area planted to economic woods such as mulberry, tea, and fruits. In 1975, the province's area devoted to mulberry, tea, and fruit groves was 754,000, 136,000, and 466,000 mu respectively.

Silkworm mulberry was formerly dominant on the Lake Tai Plain in southern Jiangsu, which was one of the renowned major areas of production in the country. Because it was planted in scattered places or interplanted in grainfields, when fields were leveled, it was frequently uprooted and the area declined. However, counties like Wuxi are in process of making readjustments, selecting continuous tracts of land for growing it. Substantial expansion in the growing area has taken place in northern Jiangsu and in the Zhenyang hills. In terms of the province as a whole, the area has increased, and silkworm cocoon output has risen 162 percent during the past 10 years. Silkworm mulberry production is being revived and consolidated in its old area of Lake Tai where mulberry trees are being concentrated in new continuous tract groves. There is to be continued development in northern Jiangsu and in the Zhenyang hills, both lake mulberry and tree mulberry being developed at the same time, the leaves and the timber both being used.

The hillsides of southern Jiangsu, where the growing of tea has a long history, are the province's principal production area for tea. Tea groves are distributed in all of the counties of the Yi, Li, and Mao mountains, and in the hill regions of Jiangning and Zhenyang. Tea grown in Wu County and in the eastern and western Dongting Hills is of superior and famous quality. In recent years, this tea has moved northward to the hilly region of Yiliupu, north of the Chang Jiang, where new tea groves have been established and are growing well.

Fruit tree varieties are numerous. Semi-tropical evergreen fruit trees include citrus, loquats, and red bayberry, which are concentrated along the shores of Lake Tai, in the eastern and western Dongting Hills, and in the foothills of the Maji Mountains. These are the province's only evergreen fruit producing areas. There is room for future development of these areas, and growing can be expanded. In the Jiangning-Zhenyang hill region, peaches, Chinese chestnuts, dates, apricots, and Chinese pear-leaved crabapples are quite common. On Changjiang delta plain, deciduous fruit trees are dominant,

peach trees being largest in number. This is the major white juicy peach producing area. In addition to the growing of dried fruits such as persimmons and dates for a long period of time, since the advent of people's communes, the northern Huai fruit growing area has developed large tracts of deciduous fruit trees, which are concentrated in the old bed of the Huang He and along the banks of the Yi, Shu and Zhu rivers. It is now producing large quantities of fruits and has become the province's largest fruit producing area, producing mostly apples, white pears, and grapes.

Since Liberation development has taken place in the growing of woody oil-bearing plants such as tea oil trees, tung oil trees, Chinese tallow trees, walnut trees, and ginkgo trees; however, neither the area nor output is large. In recent years tung oil trees have been cleared away to make room for the growing of more grain, and their area of cultivation has declined. They should be revived and developed in future. Chinese tallow trees are extremely adaptable and may be grown everywhere in the province in the four besides. Growing of tea oil trees should be actively consolidated and increased.

5. Aquatic Products

Jiangsu Province possesses vast aquatic products fishing bases and superior conditions for the breeding of aquatic products. Both the freshwater and marine fishing industries occupy important positions within the country. Aquatic products output totaled 360,000 tons in 1975. This included 181,000 tons of marine aquatic products and 179,000 tons of freshwater aquatic products for a total output increase of 148 percent over 10 years previously. A substantial increase occurred particularly in the output of marine products. In 1975, output of freshwater products was 107 percent of what it had been in 1965, while it was 214 percent for marine products. In 1965, marine products output was only half that of freshwater products, while it is now somewhat more.

The freshwater fishing industry exists virtually everywhere in the province. There are 33 fishing communes, 308 fishing brigades, and fisherfolk total 310,000, most of them in Lake Tai, Lixia He and along the Chang Jiang. Formerly, in the freshwater fishing industry, about two-thirds of total output was caught, the remainder having been bred. Now, however, the ratio of quantity caught to quantity bred is 1.2:1.0. This is because during the past several years a great increase has taken place in the reclamation of river and lake areas, and there has been construction of water conservancy facilities, which have caused a commensurate decline in water surfaces and has impaired increased breeding of resources. This has resulted within a 10 year period in a 10 percent reduction in catches, while the breeding area has expanded and output has increased.

The Lake Tai regon with Lake Tai at its center is interspersed with rivers and lakes and laced with waterways of all kinds. Here the breeding and catching of aquatic products and the growing of aquatic crops are very well developed, and breeding techniques rank first in the entire province. There are, moreover, quite a few ponds that are semi-perfect or perfect for raising fish in which the extent of specialization and levels of output are

higher than for other areas. In consequence, commodity output of aquatic products for procurement is often more than 30 percent the total for the province.

In the Lixia He region, water surfaces are more numerous than in the Lake Tai region, and output of aquatic products accounts for about 12 percent of the provincial total. West of the Grand Canal, the Hongze and Gaobao lakes form the great lake complex; however, they are used mostly for water conservancy in a combination of guarding against floods and providing relief from floods. Because of the overall effect of various actions by man, changes have taken place in the water environment, and the proportion of large fish has gradually declined. In recent years as a result of the discharge of water and the building of waterways for the fish to use, output of aquatic productions has risen again, and increase in output of crabs is particularly noteworthy. In the shallow lowland basin east of the Grand Canal are numerous marshes, which are good for the breeding of aquatic animals and plants; however, because of the reclamation that has been done to make fields, these water surfaces are steadily shrinking. Nowadays the tendency is toward a combination of making catches in shallow water and breeding in connected dike areas, with gradual decline in the amount of catching done and an expansion of breeding.

In the region along the Chang Jiang, river catches predominate, and this is also the provinces major base for freshwater catches. Though output in ordinary years is only about five percent the total freshwater output, still the number of valuable fish returning upstream to breeding grounds is substantial. Seasonality is strong, catches are concentrated, and commodity rate is fairly high.

In the Zhenyang hill region, raising of fish is done predominantly in reservoirs and behind dams. The Xu-Huai region is a newly developed fishing area where breeding is done mostly in reservoirs. In recent years, outputs have increased.

The marine fishing industry includes fishing areas along the shore, in shallow water, in offshore areas, and in the distant ocean. Along the seacoast are more than 20 ports, large and small, and in the open sea are the four fishing grounds of Haizhouwan, Lusi, Dasha, and the mouth of the Chang Jiang. Open sea fishing is principally for warm water aquatic products, large and small yellow croakers, hairtails, Chinese herring, butterfish, conger pike, and jellyfish. Cold water aquatic products include shrimp and cuttlefish. Distant ocean fish types include small yellow croakers, porgy, flatfish, and cod. In the shallow coastal waters where salt and freshwater intermingle are mullet and jun [?], as well as shrimp, crabs, and scallops. In recent years both large and small croakers have substantially fallen off, mostly as a result of excessive open sea catches, which has hurt the breeding of resources. Attention must be given their preservation. The trend for butterfish and hairtails has been toward increase. In future, as fishing ports are expanded and constructed, and as more fishing boats and mechanized fishing equipment come into use, coastal aquatic products must be protected, distant ocean fishing expanded, and breeding in shallow coastal areas intensified.

Third Section. Agricultural Zoning

Zoning of agricultural regions in accordance with objectively existing regional differences in agricultural production possesses major significance for the planning and guidance of agricultural production through the adaptation of general methods to local situations.

Agricultural production in Jiangsu Province shows clear regional differences. The following two situations are primary causes of these regional differences.

1. The meshing of regional and non-regional factors causes regional differences in natural conditions for agicultural production.

Jiangsu Province straddles five degrees of longitude, with three distinct biological and climatological zones existing from north to south. Regional differences show up in heat conditions, and a clear tendency toward gradual incremental increases in a combination of water and heat, as well as in corresponding changes in types of soil and vegetation. In addition there are non-regional factors, notably the fairly complex type of terrain. There are low-lying delta, alluvial, and silted plains formed by large and small rivers, and there are plains along the seacoast formed by marine deposits. In addition, from the southwest and the north, low mountains and hills extend into the province. At the same time, hydrological conditions strongly affected by the terrain, regional climates resulting from distance from the ocean, as well as peculiar soils all have clear regional differences. The intermingling of these regional and non-regional factors forms the province's different natural regions, and it is these that form an advantageous or a disadvantageous natural foundation everywhere for the development or a disadvantageous natural foundation everywhere for the development of agricultural production.

2. The production activities of the working people over a long period of time, and the adaptation of general methods to local situations, the use, and the transformation of nature have formed regional differences in the structure, in farming methods, and in productivity levels of agricultural production.

Table 3 - 4. Numbers of Counties, Municipalities and Communes Included in Each Agricultural Zone

Agricultural Zone	Counties and Municipalities: Total		Counties and Municipalities: Partial		Number of Communes in Zone
Xu-Huai Zone	Feng County (21)	Pei County (26)	Huaian County (14)		Total: 491 communes
	Suining County (27)	Xinyi County (26)	Funing County (6)		
	Suqian County (29)	Shuyang County (36)	Hongze County (11)		
	Lianshui County (23)	Huaiyin County (26)	Binhai County (16)		
	Xiangshui County (12)	Xuzhou City (4)			
	Qingjiang City (3)	Tongshan County (36)			
	Ganyu County (29)	Siyang County (25)			
	Guanyun County (20)	Pi County (36)			
	Donghai County (22)	Siyang County (25)			
	Sihong County (25)	Guanyun County (20)			
	Guannan County (18)	Lianyungang City (10)			
	Total: 17 counties; 3 cities; 454 communes				
Lixia He Zone	Xinghua County (42)		Huaian County (14)	Haian County (14)	Total: 270 communes
	Baoying County (24)		Jianhu County (16)	Gaoyou County (27)	
	Taizhou City (3)		Dongtai County (12)	Funing County (14)	
	Total: 2 counties; 1 city; 69 communes		Jiangdu County (29)	Dafeng County (7)	
			Hongze County (14)	Tai County (21)	
			Yancheng County (22)	Jinhu County (11)	
			Total: Parts of 12 counties; 201 communes		

Coastal Zone	Sheyang County (20)	Qidong County (44)	Binhai County (7)	Nantong County (6)	Total:188 communes
			Dongtai County (12)	Dafeng County (21)	
	Total: 2 counties; 64 communes		Haimen County (18)	Rudong County (36)	
			Jianhu County (1)	Rugao County (6)	
			Yancheng County (3)		
			Haian County (14)		
Zone Along Chang Jiang	Taixing County (40)	Yangzhou City (3)	Haimen County (12)	Changshu County (12)	Total: 321 communes
	Nantong City (7)	Yangzhong County (11)	Rugao County (43)	Rudong County (12)	
	Jingjiang County (22)		Jiangdu County (14)	Tai County (18)	
	Total: 3 counties; 2 cities; 83 communes		Shazhou County (15)	Yicheng County (3)	
			Nantong County (54)	Taicang County (19)	
			Haian County (11)		
			Hanjiang County (16)		
			Total: Parts of 12 counties; 229 communes		

Zhenyang Hill Zone	Xuchi County (16)	Zhenjiang City (6)	Jihu County (5)	Yixing County (1)	Total: 254 communes
	Lishui County (16)	Jiangpu County (11)	Yicheng County (10)	Hanjiang County (11)	
	Nanjing City (25)	Dantu County (17)	Liyang County (16)	Jintan County (5)	
	Liuhe County (23)	Jiangning County (26)	Gaoyou County (4)		
	Gaochun County (19)	Jurong County (21)	Danyang County (10)		
	Total: 8 counties; 2 cities; 180 communes		Total: Parts of 8 counties; 74 communes		
Lake Tai Zone	Wujin County (64)	Jiangyin County (29)	Taicang County (3)	Liyang County (23)	Total: 369 communes
	Kunshan County (21)	Changzhou City (10)	Danyang County (18)		
	Wuxi City (18)	Wu County (37)	Yixing County (34)		
	Wuxi County (35)		Changshu County (21)		
	Wujiang County (23)		Jintan County (21)		
	Suzhou City (4)		Shazhou County (8)		
	Total: 6 counties; 3 cities; 241 communes		Total: Parts of 7 counties; 128 communes		

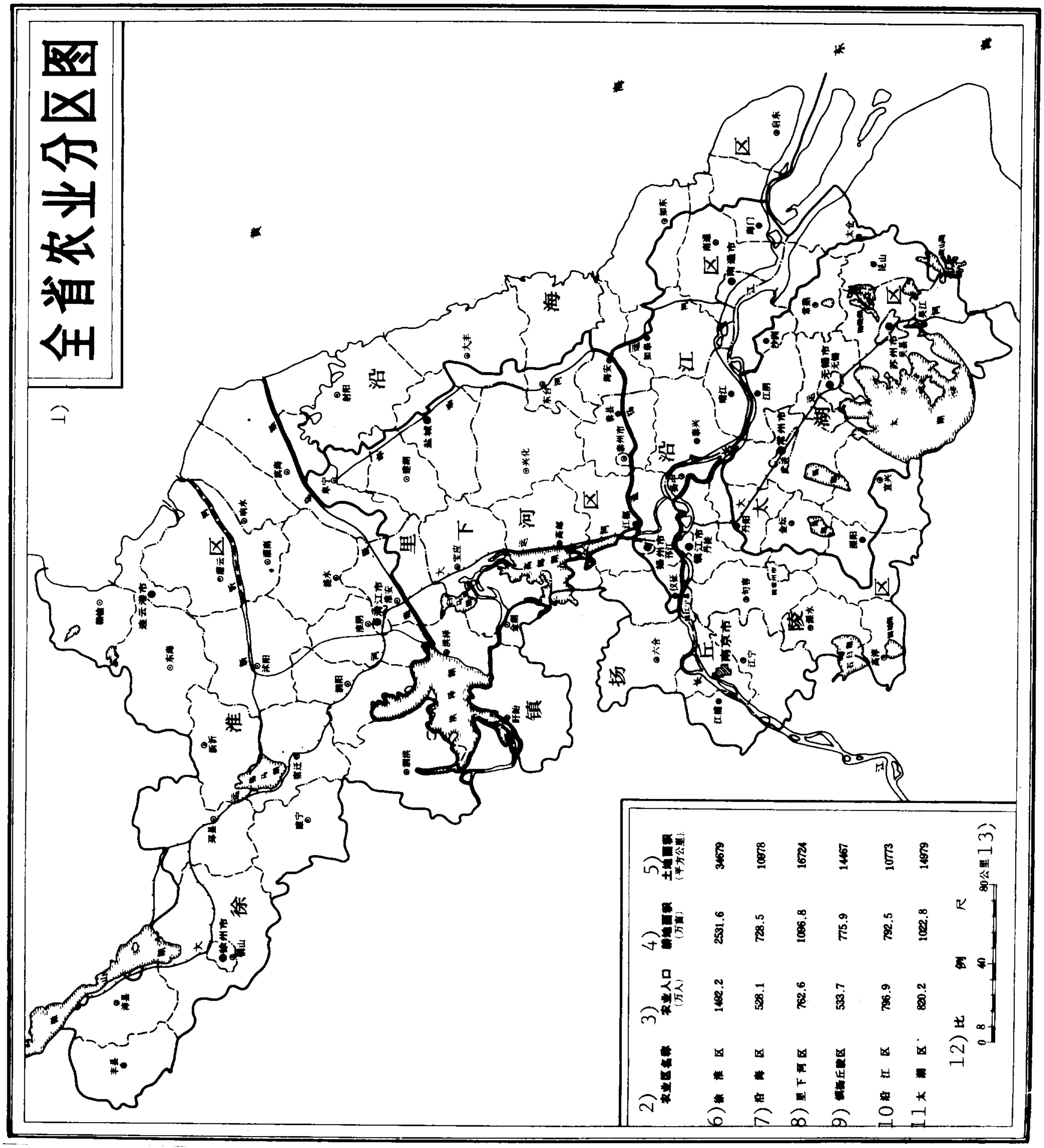
Note: Numbers given in parentheses above are numbers of communes.

Regional differences in agricultural production result not only from differences in the natural foundation of each region; more important is the result the adaptation of general methods to local situations, and the use and the transformation of nature done by the working people in the course of a long period of production activities during different historical periods and under different socio-economic systems. The history of cultivation and reclamation of soil in Jiangsu province differs from place to place. In the western part of the Xu-Huai region, it can be traced back to the pre-historic period, and development began in the Jiangning and Zhenyang hill region at a fairly early date as well. However, development of the coastal plain did not begin until after the end of the 19th century. In the process of bringing land under cultivation there was steady transformation in the gradual formation of different soil types in each region. Because of differences in water, soil, and heat conditions, and as a result of the influence and role of socio-economic conditions, and as a result of the influence and role of socio-economic conditions, the pattern and level of development of agricultural development differed from one region to another. Rice, dryland grain, and cotton crop patterns have an obvious regionality, and both farming systems and varieties used show even greater differences. Development of the livestock industry is closely related to regional differences in agriculture. As a result of differences in water and soil resources, differences have also taken place in the regional distribution of forestry and the fishing industry. In addition, the farming practices and production experiences of the masses have also varied with the places; consequently, the agricultural production structure in each place has its own special characteristics.

Following Liberation, as a result of great changes in the social system, great achievements were won in the transformation and utilization of nature. Substantial readjustment and reform of the pattern of production and of the farming system came about, and new changes occurred in regional differences in agricultural production.

On the basis of agricultural production characteristics and the relative sameness of production conditions within a certain region, and with consideration being given its similar direction of development, the province may be divided into the six agricultural zones of Xu-Huai, Lixia He, coastal, along the Chang Jiang, Zhenyang hills, and Lake Tai.

For the sake of provincial and prefectural planning of production and the implementation of planned quotas, each agricultural zone maintains intact the boundaries of grassroots units, i.e. of people's communes.



1. Jiangsu Province Agricultural Zones
2. Agricultural Zone
3. Agricultural Population (10,000 people)
4. Area of Cultivated Land (10,000 Mu)
5. Land Area (Square Kilometers)
6. Xu-Huai Zone
7. Coastal Zone
8. Lixia He Zone
9. Zhenyang Hill Zone
10. Zone Along Chang Jiang
11. Lake Tai Zone
12. Scale
13. Kilometers
14. Figure 21

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CHAPTER 4. THE XU-HUAI AGRICULTURE REGION

Nanjing JIANGSU NONGYE DILI [AGRICULTURAL GEOGRAPHY OF JIANGSU] in Chinese
Jun 79 pp 69-94

[Text] First Section. General Survey and Characteristics

The Xu-Huai agricultural region lies to the north of the Huai He and the North Jiangsu Canal and covers an area of 34,679 square kilometers (or 52.02 million mu), accounting for 33.8 percent of the province's land area. Its agricultural population numbers 14.9 million, or 30.3 percent of the province's total. The cultivated land area is 25.31 million mu, an average of 1.7 mu per capital of agricultural population. It is the agricultural area in the province that is largest in area and has the greatest population.

This region is located in the temperate zone. Summers are warm with much rain, and winters are cold and dry. The eastern coastal region has definite marine climate characteristics. Annual temperatures average 13 to 14°C. In western areas, spring temperatures rise rapidly, favoring the early sowing of early spring crops. Accumulated temperatures from average daily temperatures stabilized at greater than or equal to 3°C and 10°C are between 4,800 and 5,000°C, and 4,340 and 4,690°C respectively. In normal years there are between 2,300 and 2,600 hours of sunshine, and the annual average frost free period is from 200 to 220 days, suitable for growth of most temperate zone crops and fruits. Annual precipitation averages between 840 and 950 millimeters, declining from east to west, the average annual rate of change being 25 percent. Amount of precipitation is concentrated during summer when rainfall is heavy and torrential rains numerous. Frequent spring drought, summer waterlogging, and autumn drought cause definite damage to the sowing of crops in spring, their ripening in summer, and their sowing in fall. In addition, occassional early frost or late freezing frosts, and dry winds from the southwest during May and June hurt agricultural production.

This region is located on the southern fringe of the Huang-Huai-Hai Plain, and is dominated by the flood plain of the Huang He, including the overwashed and alluvial plains of the Yi and Shu rivers and the east coast sedimentary plain. The terrain is flat, and the layer of soil is thick, making for farming and machine cultivation over wide areas. Downlands and low mountains and hills account for about one-fourth the total land area. The rise and fall of the downlands is gentle and the soil layer fairly thick permitting the growing of

peanuts and dryland crops such as grains other than wheat and rice. Absolute altitude of low mountains and hills runs from 100 to 300 meters, the highest one being Yuntai Mountain, which is 625 meters high with a relative variation in height of from 30 to 100 meters. They are suitable for all around development of agriculture, forestry, livestock raising, and sideline occupations.

The water system of this region includes the lower reaches of the Huai, the Yi, the Shu, and the Si rivers, plus large and medium surfaces provided by the Hongze Lake, the Luoma Lake, and the Shiliang He reservoir. Groundwater is also fairly abundant. However, most of the streams that flow through the region originate in the mountains of Shandong and Anhui provinces, and amount of water is unevenly distributed in different seasons. During the high water season, about 85 percent of the total annual volume of water arrives, while in winter and spring water volume does not meet needs. Frequently disasters caused by flooding, waterlogging and drought occur.

The zonal natured soil of this region is brown soil (mountain sandy soil) and leached brown soil (mountain red soil) found in the low mountains and hills and used mostly for forestry. Cultivated soil is predominantly aqueous soils of the Huang He flood plain (including silt, two combined soils, sandy soil, wind drift soil, and mottled alkaline soil), the brown aqueous soils of the Yi and Shu river plains (including sandy yellow soil, mature yellow earth, and mature earth), the sajong black earth of lacustrine lowland areas or flat downlands (including lacustrine black soil and downland black soil), the mucky soil and the yellow earth of the downlands, and the salinated soil of the coastal plain. Soil fertility is fairly high for the two combined soils, silt, and mature yellow earth; otherwise it is fairly low. The area of low yield soils such as mottled alkaline soil, saline soil, sajong black earth, mucky soil, wind drift soil and hilly yellow earth is large and distribution broad; consequently, soil improvement and nurture of soil fertility is one of this regions' major tasks in the development of agricultural production.

The Xu-Huai region has been developed for a long period in history, and was one of the regions in the province in which agriculture developed earliest. However, as a result of long term feudal rule, and particularly as a result of incursion into the Si and capture of the Huai by the Huang He during the 20th century, the existing water system was destroyed with the result that flood, waterlogging, and drought disasters became extremely common. This, plus the deliberate devastation of the farflung rural villages by the reactionary ruling class prior to Liberation, created a situation of numerous disasters and low output for a long period of time. Following Liberation, under the guidance of the party, vast water control activities and restructuring of production was done. Of particular note has been the major efforts in capital construction of farmlands centering on soil improvement and water control, the adaptation of general methods to local situations for restructuring of the farming system, large scale growing of green manure, expanded growing of paddy rice and firm attention to the growing of wheat, all of which have made preliminary changes in the previous long term situation of numerous disasters and low output. In 1973 the entire region attained virtual self-sufficiency in grain. In 1975, grain output totaled 9.8 billion jin, double what it had been in 1965, and 12 counties or municipalities either exceeded

or attained the targets of the "National Program." The region's cotton output exceeded "National Program" targets. However, as compared with other regions in the province, level of agricultural production remained low, grain yields being only 530 jin per mu, lower than the 781 jin per mu of the province as a whole.

In this region, emphasis is given equally to wetland and dryland agriculture in a farming system in which three crops every 2 years predominates, but with steady expansion taking place in the area producing two crops each year. This region is the province's major producing area for wheat, soybeans, peanuts, tobacco, and hemp, and cotton and paddy rice also hold a certain position in the province. In 1975 wheat output was 45.6 percent of the province's total, and output of soybeans, peanuts, tobacco, and hemp accounted for more than 60 percent of the province's total.

A definite foundation exists for economic diversification, the region being the major producing area in the province for large livestock (mostly draft oxen), slaughter hogs, goats, sheep and fruits. In 1975, the region produced about 65 percent of the province's large livestock, and accounted for 17 percent and 37 percent respectively of the province's hog, sheep and goat production. It produced 47 percent of the province's fruit.

Within the region substantial differences exist. In terms of agricultural land characteristics and orientation of land use, it may be divided into plains, lowlands, low mountains and hills (including downlands), and the abandoned bed of the Huang He. Furthermore, inasmuch as soil types and their combinations differ, distinctions may be made between inferior and first rate types. Plains may be divided into sandy soil and mottled alkaline plains, into silt plains, lacustrine black earth and sandy yellow soil plains, and into downland black earth and mucky soil plains. Of all these type soils, it is the sandy soil and mottled alkaline soil plains that constitute the Xu-Huai region's typical dryland areas growing three crops every 2 years. In recent years, a certain proportion of drylands have been converted to wetlands, and economic diversification into slaughter hogs, fruits, and silkworm mulberry has seen substantial growth. Lowlands principally encompass the Fangting He lowlands in the west, the Qiangwei He lowlands in the east, and lowlands around lakes such as the Hongze Lake where the terrain is low-lying, where waterlogging is frequent, where much human and animal labor is needed, and where formerly mostly a single crop of wheat a year was grown. During the past several years vigorous efforts have been made to improve water conservancy conditions and to convert drylands to wetlands, and gradual efforts are underway to make major rice and wheat producing areas within the region. The low mountains and hills of the eastern, central, and western parts of the region. In the downlands at the base of the mountains, and in the yellow earth downlands of the southwest, a good foundation exists for forestry and livestock raising, and the downlands are major areas for the production of peanuts and grains other than wheat and rice. The flatland of the abandoned Huang He bed has composite soil types and constitutes the province's major fruit production base. Production of cotton and grain also occupies a fairly important position. It is a farming base.

In future development of this region for agricultural production, continued efforts must be made for the capital construction of consistently high yield farmlands, all around control of water, soil, fertility, and forests, and elimination of flood, waterlogging, drought, water stagnation, and soil alkalinity disasters. There must be continued implementation of a program of "taking grain as the key link with all around development, adaptation of general methods to local situations, and a suitable amount of centralization," efforts to consolidate conversion of drylands to wetlands, active development of a two crop system and, concurrent with emphasis on grain production, the growing on suitable land of suitable amounts of economic crops such as cotton, oil-bearing crops, hemp, tobacco, and sugar crops. Also necessary is development of diversification into forestry, animal husbandry, silkworm mulberry, and fruits, and accelerated transformation of the situation of low yields and a single crop economic structure to make this region into a new commodity grain base, a diversified economic crop base, and one in which forestry, animal husbandry, and fruits predominate.

Second Section. Comprehensive Efforts on Water, Soil Fertility, and Forests to Build Consistently High Yielding Farmlands

Before Liberation, because of social and historical factors and the effects of natural conditions, the water system within this region was chaotic; waterways were choked with silt; there was no drainage area for the Huai, Yi, Shu, Si, and Zhu rivers, and flood and waterlogging disasters were extremely serious. In addition, the sandy, alkaline, infertile, and thin soils of the region plus the extensive farming methods, and low fertilization levels resulted in low and inconsistent yields from agriculture for a long period of time.

Following Liberation, in accordance with Chairman Mao's great instruction that "the Huai He must be brought under control", wideranging capital construction of farmlands began, centering around control of water and improvement of soil. One after another, projects to drain away or divert flood waters were launched including the digging of a new bed for the Yi He, the digging of the Pei-Cang diversion canal, and projects on the Huai and Shu rivers and on the Xinshu He. They dredged major waterways such as the Grand Canal, Liutang He, and Yan He, and built large reservoirs on Hongze Lake, Luoma Lake, and Shiliang He. They developed both gravity flow and pump irrigation, brought under preliminary control danger from floods, improved capabilities for the drainage of waterlogging and for combating drought, and greatly improved conditions for agricultural production. In recent years, the people of the entire region have set off a new upsurge of construction of farmlands to assure harvests despite drought or waterlogging and consistently high yields. In addition to continued efforts at control of waterways, they have also done large scale work on turning low-lying marshlands to productive use, to the building of terraced fields in mountain regions, and to the restructuring of saline, alkaline, and sandy wastes. They have done deep plowing and leveling of fields over wide areas, have improved soil and built up its fertility, have equipped farmland projects, and have launched mass tree planting and afforestation campaigns. As of the present time, the region has built 8,464,000 mu of consistently high yielding farmlands able to provide assured harvests despite drought or waterlogging. This area amounts to 35.8 percent of the collectively cultivated land area, and an average of 0.58 mu per capita of agricultural population.

However, as a result of the disturbance and destruction caused by the counter-revolutionary revisionist line of Lin Biao and the "gang of four," plus inadequate appreciation of the relationship between water control and soil improvement, the relationship between flood prevention and elimination of waterlogging and the development of irrigation, and the relationship between large master projects and the equipping of medium and small scale projects in the capital construction of farmlands, lack of overall planning and comprehensive control, the building of farmlands that produce consistently high yields has not been fast, and the number of such projects has been few and their distribution unbalanced. Most cultivated land is still in a state of neither high nor consistent yields. In terms of area distribution, lacustrine lowland areas are most numerous accounting for 41.8 percent of the cultivated land area, or an average of 0.64 mu per capita, while hill and mountain areas amount to only 18 percent of total area or an average of 0.33 mu per capita. Major current problems in farmland capital construction are as follows: (1) Flood prevention standards are low, and the problem of outlets for flood waters has yet to be entirely solved, the flood and waterlogging contradiction being conspicuous. (2) The rate of assurance of irrigation water sources is low. (3) The area of low yield soils is still rather large and fertilizer application levels rather low. (4) Some of the fields are not level and soil erosion is serious. In order to build consistently high yielding fields of high standards, it is necessary to direct attention to the aforestated problems and carry out comprehensive efforts on water, soil, fertility, and forests. Efforts should center on water control and soil improvement to hasten progress in the building of consistently high yielding farmlands that produce an assured harvest despite drought or waterlogging.

1. Further Major Efforts in Water Conservancy Construction to Eliminate Floods, Waterlogging, Droughts, and Water Stagnation

Simultaneous efforts must be given to flood prevention and elimination of waterlogging with the main attack directed against waterlogging and water stagnation in the building of water conservancy in this region. Water resources must be developed and ability to withstand drought upgraded for the realization of "water being available when drought is encountered, and drainage when waterlogging is encountered," to achieve assured harvests despite drought or waterlogging.

(1) Continued Control of the Huai, Yi, Shu, and Si, and Elimination of Flood Damage

Because of the substantial number of changes in projects and regimens in control efforts underway in the middle reaches of rivers entering this region, which have not been reciprocated in the upper and lower reaches, outlets for flood waters in the lower reaches are too few, and flood prevention standards are too low. In Anhui Province, the Xinbian He capable of carrying 1,600 cubic meters of water per second has been dug, and the Xin Huai channel to the Hongze Lake, capable of carrying 4,200 cubic meters of water per second is in process of being dug. If a flood situation such as occurred in 1954 were to occur again, it is estimated that the total volume of water entering the Hongze

Lake in a 30 day period would increase from 30 billion cubic meters to 36 billion cubic meters and the flood level would rise to 15.5 meters as compared with the 1954 high water mark of 1.5 meters. The flood crest entering the Hongze Lake would increase from 15,800 cubic meters per second to 18,000 cubic meters per second, while current capabilities to discharge flood waters is only between 13,000 and 16,000 cubic meters per second. On the Yi, Shu, and Si rivers as well, changes in water volume have also been substantial. Changes have been particularly great as a result of the construction project in the mid section of the four southern lakes in Shandong Province and construction of the Hanzhuang river diversion project. The volume of water out of the four southern lakes has risen from 490 cubic meters per second in 1957 to the present more than 3,000 cubic meters per second, and with future continued expansion, the volume of water from the two projects mentioned will double. An increase has also taken place in the volume of water coming from the upper reaches of the Yi and Shu rivers, while capacity of all watercourses to discharge flood waters are far from meeting the new requirements. For example, in 1974 when the total volume of flood waters from the Yi and Shu rivers was less than in 1957, because of the lack of facilities to discharge flood waters in the four southern lakes in Shandong, the water level in Luoma Lake rose to 25.52 meters exceeding designed level by 0.5 meters. Furthermore, because of poor management, the embankments of watercourses for the discharge of flood waters are weak, the beds of watercourses have become silted, and numerous obstructions are present in them, thereby reducing their originally designed flood prevention capabilities. Consequently, Huai He flood prevention capabilities are sufficient to withstand only a flood on the 1954 scale, and the Yi and Shu rivers would not be able to withstand a flood on the 1957 scale.

In order to eliminate flood threats with all possible speed, in addition to the need for improving management over existing projects for the discharge of flood waters, clearing out channels and removing obstacles, and strengthening lake and river embankments so that floodwaters pass freely, also necessary is the new building and continued building of basinwide projects to increase the volume of flow into rivers and into the sea to solve the problem of an outlet for flood waters.

1. Expansion of floodwater outlets for the Yi, Shu, and Si rivers. In coordination with the project in Shandong Province for the eastward movement of waters of the Ji and Shu, expansion is currently underway in the Xin Shu He to increase its flood discharge volume to 6,000 cubic meters per second or forced movement of a volume of 7,000 cubic meters per second. This would bring it up to standards encountered at Luoma Lake once in a hundred years whereby 80 percent of flood waters from the Yi He will be moved to the Xin Shu He to go on to the sea thereby greatly reducing the volume of water entering Luoma Lake. Luoma Lake will thus be able to take flood waters from the four southern lakes in Shandong Province and from the Southern Canal discharging them into the sea via the Xin Yi He. In order to take care of water coming in from the four southern lakes in southern Shandong in combination with northward movement of waters from the south, capacity of the Southern Canal to move flood waters should be brought to 7,000 cubic meters per second through deep dredging. The Xin Yi He's capacity to move flood waters should also be

increased from the present 6,000 cubic meters per second to 8,000 cubic meters per second.

2. Opening of a channel for the Huai He to reach the sea. As was said above, waterways by which waters from the Huai can flow into other rivers and reach the sea are insufficient to cope with needs to discharge water from the middle reaches of the river. Therefore, it is necessary to further expand watercourses into rivers to handle a volume of 15,000 cubic meters per second. In order to get to the root of the problem of outlets for waters from the Huai, thought should be given to opening a path to the sea for the Huai He north of the North Jiangsu Canal with a designed flow capacity of 14,000 cubic meters per second in addition to the 15,000 cubic meter per second capacity of the North Jiangsu Canal to transport water into the sea.

(2) Dredging of Waterways to Drain Waterlogging, Building of an Integrated Drainage and Irrigation System, and Elimination of Waterlogging and Stagnation Damage

With upgrading in standards for waterways to discharge floodwaters, and with gradual solution to the problem of outlets for floodwaters, the flood and waterlogging contradiction will gradually be ameliorated. In addition, this region's large area conversion of drylands to wetlands will also improve capabilities to prevent waterlogging and stagnation disasters. However, current standards for waterways to drain waterlogging are still rather low. Waterlogging drainage standards for some watercourses are not up to requirements encountered once every 5 years. Standards for the Kui He, the Fuxin He, the Qiangwei He, and the small Yinan He will not meet requirements encountered once every 3 years. Furthermore field projects have not been equipped; drainage and irrigation facilities are not separate; there are gaps in drainage facilities; streams and ditches are silted, making for problems in the drainage of water and rises in the water table, so that every time it rains, damage from waterlogging and water stagnation is still fairly severe. In 1974, in Xuzhou Prefecture along, the waterlogged area amounted to more that 4 million mu, waterlogging of more than 1 million mu of which was serious enough to cause a drop in yields. Today in this region, 60 percent of farmlands can drain waterlogging when daily rainfall is greater than 150 millimeters, and the water table is controlled at less than 1 meter in only 27.7 percent of places. In lowlands along rivers and lakes it is less than 20 percent.

In order to thoroughly eliminate waterlogging and water stagnation damage, it is necessary first of all to dredge the major watercourses that drain away waterlogging and to build master projects for the elimination of waterlogging to meet needs such as might occur once in every 5 years. Second, it is necessary to intensify the equipping of field projects, to build master waterway networks (main and branch waterways), basic waterway networks (large medium, and small ditches), and soil moisture networks (capillary, connecting and overflow ditches) in a network system. Next, it is necessary as waterlogging and stagnation require, to practice graded control and tract by tract control. In regions in which flood waters come in from up above making drainage of waterlogging difficult, as in the area around Weishan Lake, Luoma Lake, and

Hongze Lake, and in the lower reaches of the Xin Shu He, north of the Pei, north of the North Jiangsu Canal, and along the Grand Canal, in addition to solving the problem of an outlet for floodwaters, it is also necessary to build retaining walls around lowland areas, build pumping stations, dig culverts, and increase electric pumping capabilities to prepare in advance of the high water season (lowering the water in advance) and rush pumping during the high water season (doing electric machine pumping). In places in which drainage waterway standards are low, field facilities not equipped, and drainage not readily achievable as in the case of the sandy soil and mottled alkaline soil plain to the west of the Grand Canal, and south and north of the Yi He, and in parts of the silt and mature soil plain, further dredging of watercourse should be done and an integrated drainage and irrigation system established to manage water going into the fields. In locked-in marshy lowlands where there is no outlet through which water can be drained, such as the Machang Marsh in Shuyang County, the Yuanwang Marsh in Suqian County, and the Dianhu Marsh in Lianshui County, drainage outlets should be opened and enlarged. Until such time as an unimpeded outlet exists, a water pumping system should be set up that takes account of the height of the terrain for much pumping when the water is high and drainage when the water is low. In seacoastal areas where tides cause reverse irrigation and drainage is blocked, in addition to retaining walls to block the water and the building of gates to stem the tide on all waterways entering the sea, it is also necessary to clear away sand and silt to keep the high tide out and to rush pump at low tide.

(3) Active Development of Water Resources to Satisfy Irrigation Needs

The Xu-Huai region is currently irrigating an area of 11 million mu amounting to a little less than one-half the collectively cultivated area. Of this total, about 6 million mu, or only one-fourth, is able to withstand drought more than 70 days, as in the hill and mountain regions only one-tenth can do so. Most of the cultivated land has no irrigation facilities, and ability to withstand drought is very low. Lakes and reservoirs in the region are currently able to store about 5.5 billion cubic meters of water in normal years. In addition to satisfying inter-regional irrigation, shipping, industry and urban use, this could virtually satisfy supplemental water needs of about 7.9 million mu of paddy rice and some dryland crops. However, the water is unevenly distributed. For example, in the Weishan Hu irrigation area in the west, for each mu of rice there is an average of only 220 cubic meters of water, only sufficient to supply needs for water when rice is transplanted. Secondly, the water resources certainty rate is poor. If as a result of scant rainfall during the spring or autumn season the flow into lakes and rivers were to suddenly stop, and lakes and reservoirs were not able to store sufficient water for the current year, use of water for irrigation in the following year would be directly affected. In the 15 year period between 1959 and 1973, the main stream of the Huai river stopped flowing for 9 years. This was an average of once in less than every 2 years.* For 4 consecutive months between early October 1973 and late January 1974, it did not rain, and the water level in lakes and reservoirs throughout the region

*The 9 years when the flow stopped were 1959, 1960, 1961, 1963, 1966, 1967, 1968, 1972, and 1973.

fell dramatically. Despite urgent measures to combat drought and heroic measures to replenish lakes, only the need for water to transplant rice could be solved. As agriculture develops further, in order to assure water for irrigation of large areas of rice and dryland crops, further expansion of water sources for irrigation is necessary to improve the certainty rate for water sources. Most important is efforts in the three directions of further development of water resources, sensible management of use, and planning and conservation in the use of water.

Further development of water resources: (1) Increase in the storage capacity of existing lakes and reservoirs. It has been calculated that if the normal water level of Hungze Lake, Luoma Lake, and Weishan Lake were to be raised 1 meter and the Shiliang He reservoir were to be built to 26 meters, water storage capacity would increase by more than 3 billion cubic meters. (2) Full use of favorable terrain to build reservoirs and dams to intercept and impound surface water to increase amount of storage. (3) Building in the lower reaches of watercourses necessary control projects, as for example, control of Yandong and Tangjian, and control at different levels of Zhangji. In this way both water for shipping can be conserved, and surface runoff and runback water intercepted and stored so that water for irrigation may be raised for use on both banks of the lower reaches of the Chaimi He and the Liutang He. (4) Further development of groundwater resources, and development of well irrigation. These are important ways to solve the insufficiency of water for irrigation in this region. Most areas have ample groundwater with the exception of the western hill regions of Donghai and Ganyu counties and the Tiqiu hill region of Xinyi where groundwater is lacking, and coastal areas where quality of groundwater is poor. Thus in areas lacking river and lake water resources (to the west of Weishan Lake, both shores of the abandoned bed of the Huang He, and the Tongshan, Suining, and Pei county areas), active development of irrigation from wells is called for. In irrigation areas served by rivers and lakes, wells should also be sunk for supplementary water sources to solve the need for water of dryland grain crops and some seedling fields in the building of a combination well and river irrigation area. (5) Continued completion of the project for the northward movement of waters from the south (northward movement of waters of the Huai and the Chang Jiang using the Grand Canal as the main artery with numerous stations for the pumping of water, and the three lakes (Hongze Lake, Luoma Lake and Weishan Lake) to regulate quantity to augment irrigation sources in the region.

Rational control of use. Inasmuch as development of water resources, improvement in irrigation conditions and expansion of the rice growing area in various places differ, management and distribution of the waters of the Huai and the Yi should be considered in common and further readjustments made. In areas north of the old bed of the Huang He into which water from the Huai may be diverted, all possible means should be devised to divert waters for irrigation. In areas along the Grand Canal and along the North Jiangsu Canal south of the abandoned bed of the Huang He, transformation can be made to an irrigation area in which river diversion to supplement irrigation is paramount. Only when the normal storage capacity of Hongze Lake has been exceeded and water has to be released should water from the Huai be used so as to save on pumping to divert the river. In consideration of the fact that times differ when waters enter the Huai and the Yi, their use must be mutually regulated, making

the central canal and the Huai and Shu rivers as the main regulating rivers for irrigation waters from the Huai and the Yi so that water from Yi can both flow into the Huai and waters from the Huai can be turned to give help to the Yi. To do this, it is necessary to build water crossover stations at Siyang, Liulaojian, and Suqian. In order to make the waters of the Huai be able to continue their northward movement to Weishan Lake, it will be necessary to build crossover stations on the Zao He, at Liushan, at Jietai, and on the Linjia Dam. In the area west of the Huai and Shu rivers, an irrigation area jointly served by the Huai and the Yi may be set up, the waters of the Huai being used when the Huai He contains a large amount of water, and the waters of the Yi being used when the Yi He contains a lot of water.

Planned use and conservation of water. Today heavy use of water for irrigation and large scale draining away of water is fairly severe. A great gap exists from one place to another in amount of water used. In irrigation areas in which water is used fairly well, water flow averages 1.2 meters per second per 10,000 mu of rice fields; however, in places where management is poor more than 3 meters per second is used, more than double the difference. For example, the irrigation area north of the Yi has 154,000 mu of ricefields where, because of poor management water is used at a rate of 45 meters per second, tests showing that a flow of 28.6 meters per second is wasted. Thus it is necessary to intensify management over water use, perfect irrigation systems, plan use of water, and conserve use of water. Furthermore, the potential in this region for use of runback water is also very great. Test data from the Luoma Lake irrigation area on the use of runback water shows that within the area of a single medium size ditch, runback water accounts for 72 percent of the total amount of water released, and in most areas the amount of runback water varies from between 30 to 50 percent. Serious attention must be given the re-use of such water. Runback water also contains a certain amount of nutrients, so use of runback water for irrigation has somewhat better results in increasing yields that use of clear water from lakes or reservoirs for irrigation.

2. Vigorous Efforts to Nurture Fertility and Improve Soil Fertility

Soil fertility is fairly low in the Xu-Huai region. There are numerous kinds of soils that produce low yields, and they are spread over a wide area. The principle low yield soils are saline-alkaline soil including mottled alkaline soil (saline-alkaline, wa [3907] alkaline, and lu [7767] alkaline), and the saline soils along the seacoast (resalinated soil, lightly salinated soil, and heavily salinated soil). Mottled alkaline soils are widely distributed on the alluvial flood plain of the Huang He, and their salt content is generally not high (0.1 - 0.3 percent). However, during the dry season, it is concentrated in the surface layer of the soil where it causes great damage to crops. Some mottled alkaline soils (wa alkaline) also produce alkaline (sodium carbonate) damage. Saline soils along the seacoast are suffused throughout with salts, principally sodium chloride, and the lower soil layers contain more salts than the surface layer, but no alkali. Nutrient content of saline-alkaline soils is also low. In seriously saline-alkaline soils, crops usually will not sprout, and even for salt-tolerant crops (such as cotton), yields are not high. In lightly saline-alkaline soils lack of a full stand of crops is fairly

serious and grain yields are usually only 100 to 200 jin per mu. Once saline-alkaline soils have been desalinated through improvement, further nurture of their fertility is very important; otherwise, they are prone to resalinization. In the Xu-Haui area, still other low yield soils include sajong black earth, mucky soil and wind drift soil. The reason for the low yields of sajong black earth is the heavy nature of the soil. It cannot be easily cultivated. When the terrain is low and level, it is prone to waterlogging, but loses moisture quickly and becomes arid extremely readily, and sometimes sajong characteristics cause damage. Mucky soil retains water and forms into sticky balls that are infertile. Wind drift soil is sandy and infertile. None of these soils is good for the growing of crops. Soils other than low yield soils generally lack a high nutrient content and their organic content is less than one percent. Therefore, for a long time, low yield soils have been one of the main reason limiting high yields in agriculture.

Following Liberation, as a result of constant soil improvement and nurture of fertility, an appreciable area of low yield soils were improved in varying degrees, and soil fertility was generally improved. However, today development is very uneven, and vigorous efforts to improve soil and nurture its fertility remains one of the major future tasks in building farmlands that produce consistently high yields.

(1) Leaching of Salinity (or Alkalinity) to Grow Rice, Using Water to Improve Soil

When saline-alkaline soils are irrigated or when drylands are changed into wetlands, not only can paddy rice production be developed and grain output increased, but irrigation also produces benefits in conspicuous reduction of salinity (or alkalinity), and washing away the salt, hasting the desalinization of the soil. Comparison of measurements shows that wa alkaline soil with a cultivated layer salt content of 0.2 percent and lu alkaline soil with a cultivated layer salt content of 0.6 percent experienced a decline of salinity to about 0.05 percent after several years of irrigation, and soil alkalinity also declined, the pH value going from 9 - 10 to 8 - 9. Experience in the Mengzhuang Brigade of Zhangji Commune in Tongshan County and in the Daxin Commune in Suqian County shows that after planting a seriously saline-alkaline plot of soil with paddy rice for a 3 or 4 year period and transplanting green manure to it, crystals of salt and alkali were vitually eliminated and harvests of more than 500 jin per mu became possible. However when no paddy rice was planted, but rather dryland crops (such as cotton) were intensively cultivated, though fairly high yields were also possible, the salt and alkali crystals were difficult to eliminate. This shows that a change to the growing of paddy rice on alkaline-saline soil can produce the twin benefits of increased yields and soil improvement. However, when drylands are converted to wetlands, the problem of a outlet for water that is drained away has to be solved, the situation of "water surrounding drylands" and "drylands surrounding water" being avoided so as to prevent the migration of salinity and alkalinity that brings about secondary salinization of nearby fields of soil. In coastal saline soils, both salt content and ground water mineralization are very high, and serious attention should be given drainage. In lightly saline-alkaline

soils, where the problem of sources of water for irrigation are somewhat difficult to solve, though paddy rice may not be grown at the present time, attention should be given to leveling the land and improving drainage conditions thereby further desalinizing them.

(2) Planting of Green Manure to Nuture Fertility and Improve Soil

Yet another common characteristic of the soils of the Xu-Huai region is they are sandy, infertile, and thin. In order to increase the soil's organic content, increased applications of organic fertilizer are very important. On the basis of the experience of Suqian and other counties, it is necessary first of all to adapt general methods to local situations in large scale growing of green manure. In seriously mottled alkaline soils, generally salt tolerant summer green manure in the form of sesbania, sweet clover and eel grass [Valisneria spiralis] should be grown. After the stems and leaves of these green manures have closed, evaporation can be controlled to prevent resalinization, and the accumulated organic matter can increase the soil's nutrients to improve soil structure. However, eel grass will not tolerate waterlogging, so waterlogging has to be reduced. In lightly mottled alkaline soil and in most dry soils, winter green manures such as Chinese trumpet creeper and summer green manures such as false hemp and sesbania. Not only Chinese trumpet creeper but also Chinese milk vetch may be vigorously grown in paddy-fields. In future, as the farming system changes and the multiple cropping index gradually increases, winter and summer fallow fields will become increasingly rare, and green manure will come to be increasingly intercropped, companion cropped or transplanted. This region already has had numerous good experiences with the intercropping, companion cropping, and transplanting of green manure. For example, companion cropping of wheat with winter green manure (Chinese trumpet creeper), and companion cropping of wheat with summer green manure (clover and sesbania) with clover, false hemp, or sesbania being transplanted following the wheat harvest. Following the harvest of dryland autumn crops such as corn and gaoliang, false hemp has been transplanted, and in cotton fields there has been companion cropping of spring green manures for use by the cotton as a follow-up application of fertilizer. In 1976 Pei County's cotton fields were companion cropped with green manure over an area of almost 50,000 mu, an almost general 20 percent increase over the fields not companion cropped with green manure. As water conservancy endeavors develop and water surfaces increase, the growing of "three waters" and one duckweed is also increasing to open new avenues for increase in fertilizer resources.

Secondly, increased fertilization with phosphate and potash fertilizers is also very important. Though the soil of the Huang He flood plain is rich in lime, and though its phosphate content is fairly high (0.1 to 0.18 percent), when a great amount of limestone and phosphate is present, it cannot be readily absorbed for use. This is particularly the case with sandy soils (such as sandy soil, soaked sandy soil, wind drift soil, and mottled alkaline soil) in which quick acting phosphorous content is low and additional applications of phosphate fertilizer required. In changing its limestone soil drylands to wetlands, the Xiangyang Production Team of Dongfeng Production Brigade in Xiangshui County used calcium superphosphate, which was remarkably effective in increasing yields of Chinese trumpet creeper, sesbania, rape,

wheat, and paddy rice. Since limestone soils fairly rapidly fix quick acting phosphate, phosphate fertilizer must be applied in concentrated form or else composted together with organic matter, the better to make long lasting compound fertilizer. In downlands mucky soils, total phosphate and quick acting phosphate content is very low. Application of phosphate fertilizer has great effectiveness in increasing yields of peanuts and sesbania. Phosphate content of sajong black earth is moderate, but quick acting phosphate content is not high and application of phosphate fertilizer is required.

The sandy soils of the Huang He flood plain are the ones in this region that are fairly lacking in potash, their slow acting potash content being only between 30 and 60 milligrams per 100 grams of soil. Experiments have shown that fertilization with potash can effect increased yields of from 6.5 to 23 percent in sweet potatoes, cotton, tobacco, peanuts, and soybeans. Downlands mucky soil is noted in this region for its lack of potash, its slow acting potash content being as low as 30 milligrams per 100 grams of soil. Fertilization with fly ash potash at the rate of 50 or 60 jin per mu produces remarkable increases in yields of peanuts, soybeans, sweet potatoes, and sesbania.

Use of trace element fertilizer is one of the ways in which this region can increase soil fertility and increase crop outputs. Preliminary research shows that in the sandy soils, two combination soils, and silt soils of the Huang He flood plain, in the mature soils (yellow clay) of the Yi and Shu river plains, in the mucky soils of the East China Sea downlands, and in the black lacustrine soils of lowlands, molybdenum and manganese content is fairly low. In the downlands mucky soils, in particular, effective molybdenum is inadequate, and in the limestone soils of the Huang He flood plain, manganese content is very lacking. Remarkable increases in output of soybeans and peanuts can be realized through application of molybdenum fertilizer to these soils, and manganese fertilizer shows rather good effectiveness in increasing yields of wheat, cotton, and peanuts.

(3) Leveling Fields and Turning Over the Land Using the Soil to Improve the Soil

The plains and lowlands of this region contain numerous wasteland ravines and sinkholes of no value. The surface of the land is level in a general sense, but not in detail. Leveling of the soil can both effect savings in the use of water to improve effectiveness of irrigation, and can increase the quality of plowing by causing the depth of plowing to be even so, that the soil drys or moistens at the same rate, which helps make fullest use of soil nutrients. On sandy soil and mottled alkaline soil plains, leveling of the land is particularly important as a means of preventing resalinization of the soil. When leveling the soil, it is important that the soil layers not be disturbed, the mature soil layer being kept on top and the raw soil kept below. When the surface layer of soil is overly sandy or overly clayey, a combination of soils may be used for leveling using the methods of "turning up the sandy soil to mix with the silty topsoil," "turning up the silty soil to mix with the sandy soil," "mixing sandy and silty soils together," and "turning over black soil," in the use of soil to improve soil.

Beneath the sandy soil of the Huang He flood plain frequently lies silty soil (clay), and below the silt frequently lies a layer of sandy soil. The masses frequently use the method of turning up soil and mixing it with other soil to convert overly sandy or overly clayey soils into two combination soils. In places where the lower layers contain no sandy soil or no silty soil, soil is brought from elsewhere, sand and silt being mixed together. The masses frequently use sandy soil or silt as a bedding for pig stys to produce a soil and manture mixture, after which they mix the sandy manure soil with silt and the silty manure soil with sand for good effect.

Turning over of black soil is a fine method of using the soil to improve the soil that is practiced in the eastern part of Lianshui County and in Xiangshui County. In those places, beneath the mottled alkaline soil layer a 1 meter thick layer of heavy black clay soil may be found, the depth at which it is buried depending on the elevation of the terrain, the higher the elevation, the deeper it is buried, usually at from 2 to 4 meters. The masses turn this black soil over and cover it with heavily saline-alkaline soil (to a thickness of from 16 to 18 centimeters) thereby converting the heavily saline-alkaline soil, which will produce not so much as a single grain of harvest, into a good soil with grain yields of from 400 to 500 jin per mu. They both dilute the soil's salinity and alkalinity and increase its nutrients to change soil properties. The turning over of black soil has become an important experience for places that have black soil to turn over in improving mottled alkaline soils.

In hilly regions, the building of level terraced fields can conserve water, soil and fertility.

(4) Deep Turning Over of the Soil in Skillful Plowing to Improve Soil Properties

Deep plowing of the soil is one of the important means of improving soil and increasing its fertility. Most of the soils of the Huang He flood plain have a gummy layer and a stiff sandy layer, which prevents movement of brackish water and growth of root systems. Deep plowing can improve the sandy and clayey properties of the soil as well as its porosity, and also helps improve salinity and alkalinity. Some other soils should also be deeply plowed. But deep plowing requires much labor, and to make up for their labor shortage, the local masses have resorted to the "field ridge deep plowing" method. By this is meant that following the autumn harvest, they deep plow the rows to be planted with crops the following year, using the earth they have turned up to build a false ridge in the fields, which they then allow to weather. Following the lunar new year, they level this false ridge and make a new ridge along the furrow they had deeply plowed, and then plant their crops. This method is rather much used on the downland mucky soils of Donghai County where plowing is usually done down to the purple mud layer, the furrow being about 60 or 70 centimeters deep. This method not only makes the friable soil layer thicker, but also improves the "mucky waterlogged seedling" situation. At the same time the purple mud layer (clay soil) that has been turned up is mixed with the surface layer of mucky soil (sandy soil), which also improves the soil's sand-clay properties. Use of this method with lacustrine black soils also showed rather good results.

Because soil properties of lacustrine black soil and silt soil areas are overly clayey, plowing is difficult, and frequently improved plowing techniques are necessary, as for example, sunning of upturned soil for summer plowing and freezing upturned soil for winter plowing, which are effective measures for improving soil plowability and increasing soil nutrients. In recent years, plowing methods that improve soil have been gradually combined with the transplanting of green manure to further improve soil fertility. The time when lacustrine black soil and silt soils can be plowed is very short, so skillful plowing becomes extremely important both in order to assure the quality of plowing and to save labor. It is also necessary to plow sandy soils and mottled alkaline soils at the right time if there is to be no sodden plowing or rotting of seeds; otherwise soil structure is prone to destruction giving rise to or increasing resalinization of the soil.

(5) Afforestation to Improve Soil and Development of Fruit Trees

Adaptation of general methods to local situations in using the wind drift soils of the flatlands and plain of the abandoned bed of the Huang He to develop fruit trees, creation of windbreak forest shelter belts to protect fields and stabilize wind drift soil has been helpful in the steady development of fruit orchards and agricultural production. Saline-alkaline soil areas should also attach importance to afforestation as a means of improving soil. Shelter forests can reduce wind speeds, lower soil surface evaporation, thereby reducing the amount of salts that rise to the soil surface through capillaries in the soil that bring about a resalinization of the soil. Hill and downland areas and all soil areas should also plan afforestation to control and prevent soil erosion, directly or indirectly promoting soil improvement and increased soil fertility.

Soil fertility epitomizes water, fertility, weather, and heat factors; consequently, soil improvement and increase in soil fertility requires that all around measures be taken. Different soils contain different kinds of contradictions, and it is necessary to focus on and come to grips with the major contradictions in different soils and take corresponding actions to improve them in order to gradually achieve the goal of overall increase in soil fertility.

3. Adaptation of General Methods to Local Situations in Capital Construction of Farmlands

The soils of the Xu-Huai region are fairly complicated, and though the major methods of capital construction of farmlands consist of all around efforts with water, soil, fertility, and forests centering on water control and soil improvement, in different areas, the focus of these efforts and actual methods differ.

(1) Plains Type

Plains type soils account for the largest part of the cutivated area. They are concentrated in continuous tracts, and their consistently high yielding

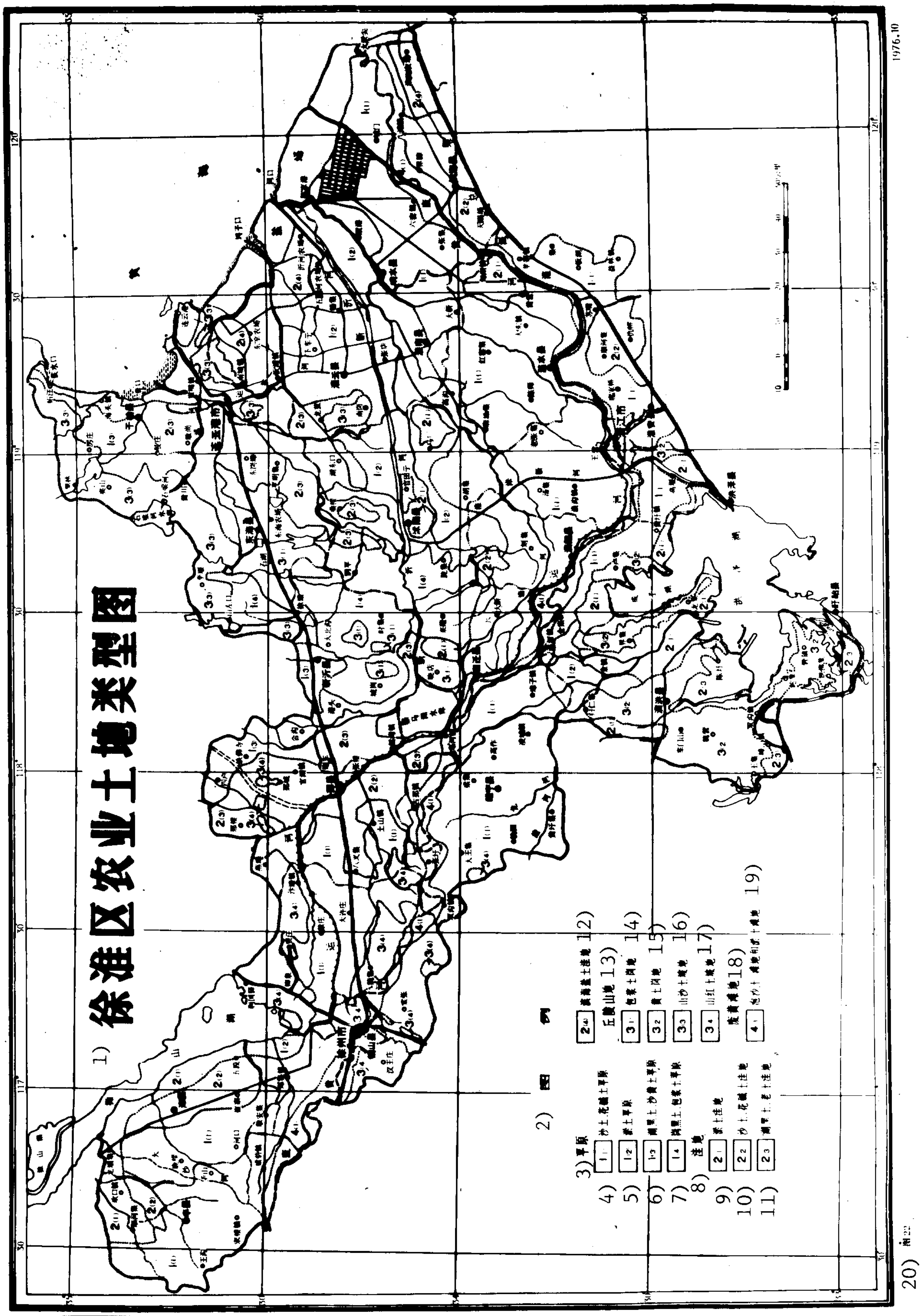
fields account for 37.1 percent of all the cultivated area. The main problems in capital construction of these farmlands are as follows: Irrigation and drainage systems are not sufficiently well developed; standards for drainage streams and ditches are low; and the equipping of field projects is poor. As a result, irrigation and drainage must contend for use of the same facilities; irrigation by channeling water along furrows and by flooding are everywhere problems, and waterlogging and stagnation damage is fairly pronounced. The low yield area is substantial, some of it overly sandy, overly clayey, or saline-alkaline. In most places the cultivated land is generally level but not level in detail. In both sandy soil and mottled alkaline soil areas, scouring through ravines and gullies is fairly serious. The experiences of Dafei Brigade in Lianshui County and of others shows that capital construction on farmlands in plains areas must center on water control, using water to bring about soil improvement, accumulating manure to improve fertility, and carrying out afforestation. First comes the building of a complete farmlands drainage and irrigation system with integration of the "three networks," in a deep, networked, separate and flat system by which is meant that ditches must be deep, the water system must be networked, be capable of being separately controlled, and watercourses must be flat bottomed. The ditch and duct system must be layed out in accordance with the local terrain and water sources, making adaptations of general methods to local situations. In places where the slope is in a single direction, irrigation should move upward and drainage downward, ditches, fields, gullies, and roads being interrelated. In areas that are high in the middle and low all around, irrigation should be done from the middle and drainage done from all around. In areas with large lakes and reservoirs, the ditch system for irrigation must be complete, and drainage and irrigation systems separate, both flood irrigation and irrigation by channeling water along furrows eliminated. In irrigation areas that raise water upward or divert rivers, large ditches may usually be used both for storage and drainage of water and for both drainage and irrigation, and to control the water table. The system must have separate small drainage and irrigation ditches to eliminate contention between irrigation and drainage for use of the same facilities, so that waterlogging may be drained away and water stagnation reduced. In irrigation areas served by wells, because of the limited water resources, usually only small ditches and farmland furrows will be layed out to bring irrigation water directly to the fields. In order to increase benefits from single wells, leak-proof cement ditches, underground podzolic soil ditches, a joined flow from a group of wells, or the integration of wells, ditches, and ponds is necessary.

In the building of a drainage and irrigation system, soil improvement, leveling of the land, and the building of fields should all be interrelated. The irrigation and drainage ditches should be the backbone of the system, alignment, orientation, and layout of fields being done on the basis of the main ditch and branch ditches, leveling being done in a planned, step by step way. At the same time, new ditches should be dug and old ones filled in, channels opened, roads repaired, and forests planted, mounds of earth moved and low spots filled in at the same time to make fields for the gradual realization of a forest network, garden-style cultivation of the land. For paddy fields in plains areas, insofar as possible, the land should be made as flat as a mirror to assure even irrigation so that each and every stalk receives water

when the water level in the fields is shallow, and so that no part of the fields retain water when they are drained. For plains dryland areas, it is important to have a uniform direction of irrigation within an irrigation field as well as a fairly uniform slope to the irrigation system. In leveling the soil, strict attention should be given to preservation of the mature soil layer, with organic fertilizer being added, and deep plowing and sunning or freezing of the upturned soil being done to hasten the process of making nutrients in the soil quick acting, achieving benefits and increased production from the leveling of the soil in the same year that it is leveled.

Full use of the surfaces of newly dug watercourses for the growing of "three waters," promotion of hog raising to accumulate manure, regular cleaning of ditches to rid them of silt, and steady provision of soil mixed with manure. In eastern areas where the black soil layer lies just below the surface, digging of ditches may be combined with removal of the black soil to improve low yield soils. For example, in Lianshui County, when the Dafei Brigade combined digging of new ditches with the turning over of black soil, it spread black soil to a depth of from 17 to 20 centimeters over 1,000 mu of sandy alkaline soil, and annually removed an average of about 500,000 dan of silt from the ditches for use as fertilizer. This it combined with green manure it grew to convert low yield mottled alkaline soil into high yield soil.

Planting of trees for afforestation is a key measure in plains areas, particularly on sandy soil plains, for breaking the wind, reducing freezing, protecting slopes, and firming up the soil. In building new irrigation and drainage ditch systems, ditches, channels, roads, and forests should all be built as part of a piece. Along side of established ditches, canals, and roads, trees should be planted. On the slopes of ditches and canals, saplings may be transplanted and grass grown. At the foot of ditch and canal slopes reeds may be planted for use as firewood to produce three storeys of firewood, saplings and trees, or bushes, shrubs, and grass (or firewood). In order to make full use of the land, on temporary ditches and dikes in the fields and on mounds that separate fields beans or vegetables (rape) may be planted, or clay soil that protects slopes can also serve to maintain ditches and preserve mounds.



[Key on following page]

Key to Figure 22:

1. Types of Agricultural Land in the Xu-Huai Region
2. Legend
3. Plains
4. Sandy Soil and Mottled Alkaline Plains
5. Silted Plains
6. Aqueous Black Soil and Sandy Loess Plains
7. Downlands Black Soil and Mucky Soil Plains
8. Lowlands
9. Silty Soil Lowlands
10. Sandy Soil and Mottled Alkaline Soil Lowlands
11. Aqueous Black Soil and Mature Soil Lowlands
12. Coastal Saline Soil Lowlands
13. Hill and Mountain Region
14. Mucky Soil Downlands
15. Loess Downlands
16. Mountain Sandy Soil Slopes
17. Mountain Red Soil Slopes
18. Flatlands in the Old Bed of the Huang He
19. Soaked Sandy Soil Flatlands and Silt Soil Flatlands
20. Figure 22.

(2) Lowland Type

Lowlands are found mostly around Weishan Lake, Luoma Lake, and Hongze Lake, on both banks of the Yi, Shu, and Si rivers, and in some coastal areas. These lowlands, which have consistently high yield fields, account for 41.8 percent of cultivated land; however, those fully meeting standards total only 16.1 percent. The main problem here is the low-lying terrain, most of the land lying below flood level, with waterlogging and water stagnation damage to crops being fairly serious. The soil is heavy, and though inherent fertility is high, poor drainage and the coldness of the soil does not permit full use of this inherent fertility. In facing up to these problems, it is necessary to take in hand elimination of waterlogging and reduction of water stagnation, deep plowing to improve the soil, and all around integration of ditches, canals, roads, and forests as key measures to be taken.

Construction of high dikes, double equipping (with sluice gates and pumping stations), four separations (the inner and the outer, the high and the low, irrigation and drainage, and wetlands and drylands), two controls (water levels within streams, and ground water table), and further restructuring (of the old river systems) are major measures in guarding against floods and draining of waterlogging in lowlands. The experiences of Paoche Commune in Yi County, and of other places as well, show that in the building of retaining dikes it is necessary to leave a corridor through which water may be drained. The dike system can be large dikes enclosing small dikes for separate control. Dike construction will depend on terrain, the water system, and the water situation, with general methods being adapted to local situations in their construction. Usually an area of from 3,000 to 5,000 mu is the proper size

to be enclosed. If they are overly large, conflicts will occur in elevations within the dike. If they are overly small, the total length of flood protection dikes will be long, and large quantities of earth and rock will have to be moved to build them. In addition, construction on the main and branch drainage waterways of pumping stations, the building of sluice gates, and installation of electric pumping equipment should be done to a waterlogging draining modulus of 0.35 - 0.5 cubic meters per square kilometer, and as production develops further, commensurate increase will have to be made in the waterlogging drainage modulus. The ditch and channel system within the dike should be of six levels including large, medium, small, capillary, connecting, and overflow to maintain the water area at between 8 to 10 percent and at sufficient depth so as to permit drainage of water, storage of water, and irrigation. In order to conserve cultivated land and improve effectiveness in lowering waterlogging, in places where conditions permit, all drainage ditches and pipes that are small in size may be put underground. In addition, in converting drylands to wetlands to enlarge the rice growing area, water storage capacity in fields may also be increased. By using the previously mentioned electric pumps and sluice gates for draining, and by using the streams and ditches to store rain water and field surface water requirements can be met in being able to withstand, to drain, to irrigate, and to reduce to assure harvests despite drought or waterlogging.

Deep plowing is a major measure for improving the clayey soil structure of lowlands, of increasing soil warmth, of making the most of inherent soil fertility, of increasing soil water storage capacity, and of preserving soil fertility. Depth of deep plowing must be done in accordance with local conditions. Most soils may be plowed rather deeply (more than 20 centimeters) while infertile and thin soils should be plowed a little deeper each year. How deep plowing is done will depend on the workforce situation. Either deep plowing plot by plot or in a continuous furrow may be done, with simultaneous layer by layer fertilization and leveling of the land to build either banked field plots, with drains and ditches, or long fields with deep soil moisture.

In addition to controlling water and improving soil, work also must be done on building rural road networks and forest networks. Layout of road networks must be done to the satisfaction of transportation of products and field management, with consideration also given needs for the use of large and small tractors avoiding, insofar as possible, bridge and culvert construction, and integrating road construction with water transportation. Ditches, channels, roads and forests should be generally interrelated. Building of forest networks may be done following plains standards; however, dikes should also be afforested to break the wind and waves and to firm up the dikes. On broad ditch and river water surfaces, in addition to their use for shipping, the "three waters" may be grown. This will both reduce wind and wave scouring of the banks, and also increase animal feed and fertilizer.

(3) Hill and Mountain Type

Hill and mountain type farmlands are found largely in Ganyu, Donghai, Xinyi, Tongshan, and Sihong counties and in Lianyungan City where there are foothills, gentle slopes, and hills. Here there are consistently high yield fields

accounting for only 18 percent of the total cultivated area. The main problems of this type farmland are the large amount of rolling of the land, the loose quality of the soil, and the serious soil erosion. In most hill and mountain areas, ponds, and reservoir project for the storage of water are few, or else they consist of isolated ponds or individual reservoirs. The rate of certainty of water is low, and drylands are relatively prominent.

The building of terraced fields to convert the "fields running away in three ways" to "fields protected in three ways" is a major task in the building of farmlands in hilly and mountain regions. Summarization of the experiences of Heilin and Banzhuang communes in Ganyu County shows that building of terraced fields requires that the width of fields be set according to the slope of the land, characteristics of the terrain, and requirements for machine plowing. Generally fields on gentle slopes are wide while they are narrow on steep slopes. They twist and turn in accordance with the terrain, being very curvy when the land is very curvy and being fairly straight when the land does not curve so much. In deep plowing and leveling of the land, the surface layer of the soil must be preserved, with no mixing of soil layers by putting higher layers lower or digging layers out to the cover the top. In addition, organic fertilizer should be applied and green manure transplanted to increase soil fertility to gradually meet requirements for "sponge fields."

Development of water resources in hilly and mountain regions requires that means of storage be provided first with storage, diversion, raising of water, and wells being interrelated. Reservoirs should be built in selected lowlands, water intercepted in the heights, and ponds and reservoirs interconnected to bring benefits through a series of actions. In this way both the area of ponds and reservoirs into which water flows can be expanded to make sure that waters do not leave the hills, and that storage between one place and another can be regulated for rational use. Consideration must be given the role of ponds and reservoirs in prevention of flooding and preservation of security, check gates and flood discharge gates being built on mountain streams, reservoirs, and ponds. In order to fully assure water sources for irrigation and to effect a permanent cure for drought, places having requisite conditions should turn water back into the hills or divert water to add to reservoirs. In laying out a drainage and irrigation ditch system, level by level irrigation should be attainable as should level by level drainage, and control exercised over the scouring of ditches and channels.

Planting of trees for the afforestation of hills and mountains is a major means of conserving water resources and preventing soil erosion. For this purpose, horizontal forest belts should be built in places in which reservoirs and pond dams are concentrated to help regulate storage of runoff and prevent dirt from entering ponds and reservoirs. Afforestation should also be done atop ditches, beside ditches, and on steep slopes. The structure of forests should be a combination of timber forests and economic forests that can both help maintain the soil against erosion and also increase economic income. Along the edges of terraced fields, saplings may be transplanted and grass grown to protect the fields and preserve the embankments.

(4) Old Huang He Bed Flatlands Type

The old Huang He flatlands are the narrow swath between the farthest northern and southern banks of the abandoned bed of the Huang He. This flatland area ranges from 2 to somewhat more than 10 kilometers in width and is generally from 4 to 8 meters higher than the flood plain of the Huang He, making it a watershed between the northern and southern water systems. Because the old bed of the Huang He have never been brought under control for a long period of time, the river bed silted up, and during the flood season the pent up flood waters overflowed; during the dry season, the river dried up. Furthermore, since most of the soil was soaked sandy soil or wind drift soil, these flatland farmlands are prone to saturation, to drought, and to blowing away. Therefore, in the building of old Huang He river bed flatlands into consistenly high yielding farmlands, prevention of floods and control of sand is most important. While bringing the old bed of the Huang He under control, it is also necessary to adapt general methods to local situations to encircle fields with dikes, store water for irrigation, plant trees, grow sapling from cuttings, firm up the sand, and protect the soil. In recent years Suqian County has practiced these measures on the old Huang He riverbed flatlands where it built more than 90 small dikes to create more than 30,000 mu of consistently high yielding farmlands.

Within the four aforementioned types of soil there are still additional distinctions, which might be classified into various secondary types. For details, please see figure 22 and table 4-1.

1) 表 4-1　　徐淮区各类型土地、耕地面积情况

3)土地与耕地面积 / 2)类 型	4)土 地 面 积			5)集 体 耕 地 面 积	
	数 量 6) (平方公里)	占总面积 7) %	占各类型面 8) 积 %	数 量 9) (万亩)	占总耕地面 10)积 %
11) 总　　计	31018.75	100.00		2371.3	100.0
12) 一、平原类型	17531.25	56.57	100.00	1689.1	71.4
13) 1. 沙土、花碱土平原	11818.75	—	67.42	1138.5	—
14) 2. 淤土平原	3325.00	—	18.96	320.9	—
15) 3. 潮黑土、沙黄土平原	818.75	—	4.66	79.4	—
16) 4. 岗黑土、包浆土平原	1568.75	—	8.92	150.3	—
17) 二、洼地类型	7712.50	24.83	100.00	411.3	17.8
18) 1. 淤土洼地	1712.50	—	22.16	91.2	—
19) 2. 沙土、花碱土洼地	1356.25	—	17.58	72.3	—
20) 3. 潮黑土、老土洼地	3712.50	—	48.15	198.0	—
21) 4. 滨海盐土洼地	931.25	—	12.11	49.8	—
22) 三、丘陵山地	4462.50	14.38	100.00	270.9	11.8
23) 1. 包浆土岗地	793.75	—	17.79	48.2	—
24) 2. 黄土岗地	1343.75	—	30.11	81.5	—
25) 3. 山沙土坡地	1206.25	—	27.10	73.4	—
26) 4. 山红土坡地	1118.75	—	25.00	67.8	—
27) 四、废黄滩地	1312.50	4.22	—	(包括在平原区内)29)	—
28) 泡沙土滩地和淤土滩地	1312.50	—	—		—

[Key on following page]

1. Table 4-1. Soil Types and Status of Cultivated Land Area in Xu-Huai Region
2. Type
3. Land and Cultivated Land Area
4. Land Area
5. Collectively Farmed Area
6. Amount (square kilometers)
7. Percent of Total Area
8. Percent of Area of All Types
9. Amount (10,000 mu)
10. Percent of Total Area
11. Total
12. 1. Plains Type
13. Sandy Soil and Mottled Alkaline Soil Plains
14. Silt Plains
15. Lacustrine Black Soil and Sandy Loess Plains
16. Downlands Black Soil and Mucky Soil Plains
17. Lowland Type
18. Silt Soil Lowlands
19. Sandy Soil and Mottled Alkaline Soil Lowlands
20. Lacustrine Black Soil and Mature Soil Lowlands
21. Coastal Saline Soil Lowlands
22. Hill and Mountain Land
23. Mucky Soil Downlands
24. Loess Downlands
25. Mountain Soil Slopes
26. Mountain Red Soil Slopes
27. Abandoned Huang He River Bed Flatlands
28. Soaked Sandy Soil Flatlands and Silt Flatlands
29. (Included within the plains region)

Third Section. Efforts to Consolidate Conversion of Drylands to Wetlands and Steady Development of a Double Cropping System.

The farming system of the Xu-Huai area has been one principally of three dryland crops every 2 years. Since the founding of the People's Republic, and particularly since the beginning of the 1970's, steady efforts have been made to reform the farming system centering on conversion of drylands to wetlands. At the present time conversion has reached the point where wetlands and drylands are roughly equal in a farming system principally of three crops every 2 years, but with steady expansion toward two crops every year. In addition, diversified forms of a system of intercropping have come into being, and the multiple cropping index has risen strikingly. The rapid development of green manure has been of particularly great importance in improvement of the soil, increasing soil fertility, consolidating the conversion of drylands to wetlands, and development of the double cropping system. Rational restructuring of the farming system has played a positive role in the preliminary transformation of the region's situation of numerous disasters and low yields to bring about self-sufficiency in grain. In future development of rice growing, the existing area must be stabilized, rational readjustments made in crop patterns, strenuous efforts made to increase yields per

unit of area, and results in conversion of drylands to wetlands consolidated. At the same time, the potential for increased yields of summer grain must be brought to fruition, with active and steady development of the double cropping system and constant improvement in grain output levels, improvement in output of economic crops such as cotton, oil-bearing plants, hemps, tobacco, and sugar so that this region will gradually become a new base for commodity grain and for diverse economic crops.

1. Stabilization of Rice Growing Area and Consolidation of Achievements in Converting Drylands to Wetlands

The conversion of drylands to wetlands is a major strategic measure for making full use of the region's water and soil resources, for steady tapping of the potential for increased yields, for rapidly increasing grain output levels, and for hastening agricultural development. It is an outstandingly successful innovation in the region's agricultural production. However, in the process of converting drylands to wetlands, owing to various objective limitations, the process has yet to be sufficiently stabilized or adequately consolidated in some areas. Looked at in terms of the region as a whole, there is a substantial amount of passivity in the rice growing area where yields per unit of area tend to be low. In 1973, rice yields averaged 448 jin per mu for the region, and this was the year of maximum yields per unit of area, while in 1974 and 1975, yields continued to fluctuate at this level, which was lower than the average yields per mu for rice in the province. The main reason was lack of guaranteed water supplies. Water for the growing of rice in this region derives principally from what has been stored in rivers, lakes, reservoirs and ponds during the rainy season (late June to early August) (the region storing about 5.5 billion cubic meters of water in normal years), supplemented by rainfall and water that comes in to the region from elsewhere. Full use of these water resources can virtually satisfy the present needs of the areas 7.9 million mu of ricefields and some of the needs of dryland crops. However, since changes in amount of annual rainfall are substantial, and since the flow of the Huai, Yi, and Shu rivers, all of which come from neighboring provinces, may stop, the guarantee rate for water sources is low. In the winter of 1973 and the spring of 1974 when there was serious drought, for instance, water levels in lakes and reservoirs fell, and water stored in rivers and ponds was insufficient. Though some river water was diverted, it was still not enough to satisfy needs in transplanting the rice and consequently, the region's rice growing area in 1974 was reduced to 6.67 million mu. Particularly in places where water storage capacity is poor, such as hill pond and reservoir irrigation areas, and in the Yi, and Shu river and Weishan Lake irrigation areas, which account for about one-third the region's total rice growing area, though only between 200 and 300 cubic meters per mu of water is available for the rice, frequently water shortages do not permit fulfillment of planned rice growing areas. Furthermore, in numerous counties and communes, water conservancy projects are not completely equipped and management is inadequate, which impairs full effectiveness of water conservancy.

Secondly, fertilizer is inadequate, levels of fertilization tending to be low. In recent years, as a result of major efforts in growing, breeding, accumulating, and making fertilizer, great increase has occurred in the region's level

of fertilization; however, today in terms of pure nitrogen, average annual fertilization amounts to only 20 jin per mu of cultivated land, far from enough to meet needs for continued increases in fields of wetland and dryland crops. It is fairly common to transplant rice seedlings into unmanured fields, and the area over which follow-up fertilizer applications are made is also fairly small. In Xuzhou Prefecture, for instance, where one-third of the rice growing area follows wheat, during the past 2 years about one half the area received no base fertilizer. In Huaiyin Prefecture, in 1975 ricefields receiving follow-up fertilization were only one-fourth the total. Growing of winter green manure in the practice of a combination of use and nurture is one of the major experiences of this region in successful conversion of drylands to wetlands. However, development of the region is very uneven and everywhere output of grass tends to be low, usually only about 2,000 jin per mu, inadequate to satisfy the needs of local fields. Consequently, when rice follows wheat, not enough fertilizer is available and outputs are low.

Next, crop patterns for rice varieties are inequitable. The proportion of late rice is large, and this impairs growing of wheat following the rice crop, and the timely planting of green manure to raise output. It also provokes conflicts in summer and autumn harvesting and planting, and in use and nurture of the soil.

In light of the aforementioned situation, except for some areas in which it has been already consolidated (such as in Suqian and Donghai), and where levels of output continue to rise, conversion of drylands of wetlands in most parts of this region requires improvements in water and fertilizer conditions, the practice of a combination of use and nurture, and rational readjustment of crop patterns in order to consolidate conversion of drylands to wetlands and make full use of potential for increased yields.

(1) Full and Effective Use of Various Water Resources, and Adaptation of General Methods to Local Situations in Planning of Wetland and Dryland Crop Patterns

At the present time when the problem of additional water from elsewhere has not yet been fully worked out, it is necessary for the region to stand on its own two feet in fully channeling and storing local surface water, and in developing its own groundwater to increase the rate of certainty of water resources. It must perfect the equipping of water conservancy project and systems of management, practice scientific management and use of water, and increase the utilization rate of its water resources. It must also equitably plan wetland and dryland crop patterns "using dryland where dryland should be used, and using wetland where wetland should be used." In lake and reservoir gravity irrigation areas such as Hongze Lake, Luoma Lake, and the Shiliang He Reservoir, where the water resources certainty rate is fairly high, while scientifically managing water and using water to actively increase the water resources utilization rate, it is necessary also to perfect the irrigation and drainage system, make full use of rivers and ditches used for the drainage of water to intercept and storage irrigation runback water, and suitably develop well irrigation in order to solve the need for water in rice seedling beds and water for large open fields. Through development of resources and

conservation in use, the rice growing areas of these regions can be expanded somewhat in places, and in the Yi and Shu river and Weishan Lake irrigation area, where the certainty rate for water resources is somewhat low, in addition to doing all possible to channel and store surface water and irrigation run back water, it will also be necessary to divert a certain amount of the waters of the Huai and make vigorous efforts to develop well irrigation, using every manner of means to increase the certainty rate for water resources. The rice growing area should be stabilized at between 30 and 50 percent of the currently cultivated area. As regards crop distribution, rotational cropping as wetlands or drylands, whichever is suitable, should be done on the low yield lowlands, saline-alkaline lands, and drylands, and a small amount of "fields that look to heaven for water" should be reconverted to drylands. In the hilly and downlands pond and reservoir irrigation areas, where water resources are scant and the rate of water assurance low, mostly dryland crops are grown and the rice growing area currently accounts for between 20 and 30 percent of cultivated land. Through future expansion of large reservoir and pond storage capacity, construction of ditches all around the hills and using ravines to channel water, an involved but fruitful irrigation system may be built that would intercept and store surface runoff, make active use of groundwater and, where conditions permit, would use diversion of water to supply reservoirs to increase the water resources certainty rate. The rice growing area might best be generally stabilized at its present ratio, and places where water resources cannot be assured might better readjust their wetland and dryland crop patterns to develop dryland grain production. In the Feng, Pei, Tongshan and Suining areas which are irrigated from wells and where water resources are scant but fairly stable, rice is grown on less than 10 percent of the area in most places. In future there should be further development of groundwater, arrangements for a rational distribution of wells and earliest possible equipping of them with mechanical or electric pumps in a gradual development of underground aqueducts and spray irrigation to raise the water resources utilization rate. Dryland crops predominate, but with expansion of the irrigated area, once dryland crop irrigation has been provided for, consideration should be given to growing more paddy rice.

(2) Close Attention to Fertilizer and Combining Use and Nurture of the Soil to Build an Equitable Paddyfield Rotational Cropping System

The growing of green manure is a key measure in solving the problems of maintaining fertility and improving soil over wide areas, combining use and nuture of the soil to win continued increases in yields. Development of the cultivation of green manure entails both expansion of the growing area, growing it in open fields and in the "10 besides," and growing it on water surfaces all at the same time, endeavoring to realize within a short period of time the "greening of every mu." It is necessary, in addition, to take firmly in hand diverse effective measures (seeds, close planting, early sowing, fertilization with phosphate, and root nodule bacteria) for an all out attack on increasing yields per unit of area of grasses. The situation of a single variety of winter green manure has to be changed, and general methods adapted to local situations for increased growing of Chinese milk vetch because it permits early plowing, and early planting, and provides fertilizer for rice seedling beds or the early crop. There should be vigorous

promotion of mixed plantings of wheat and green manure, the companion cropping of wheat and winter green manure and the companion cropping of wheat and spring green manure, the transplanting of short growing green manure following the wheat harvest, and such successful experiences to effectively solve the contradiction of a lack of fertilizer for the crop of rice that follows a crop of wheat. In the cropping pattern, the relationship between expansion of green manure and increase in multiple cropping has to be correctly handled as does the relationship between use and nurture of the soil to work green manure into the rotational cropping system on paddyfields in a sensible way. Representative experiences from Suqian and other countries have shown that, generally speaking, communes and brigades having infertile soil and lacking fertilizer, and in which the amount of cultivated land is large relative to the workforce, should "make nurture of the soil paramount" and actively develop the growing of a crop of green manure by itself in a system of one crop of year plus one crop of green manure (rice - green manure), and a system of three crops plus one green manure crop every 2 years (rice - wheat - rice - green manure). In places where the amount of cultivated land is about what the workforce can handle there should be a "combination of nurture and use of the soil" with both the growing of green manure as a crop by itself, plus intercropping, companion cropping, and raising (raising of duckweed) going on all year round, and with equal emphasis, in the practice of a system of three crops and a crop of green manure every 2 years, and a system of two crops plus a crop of green manure every year (as for example naked barley - transplanting of false hemp - rice, or wheat - companion cropping of sesbania - rice). In communes and brigades in which soil fertility is pretty good and the workforce large relative to available cultivated land, a combination of nurture and use should be practiced with "nurturing in the midst of use" using intercropping, companion cropping, transplanting, and raising of duckweed to produce green manure all year round. This should be supplemented with some raising of winter green manure as a single crop in a system of two crops and a crop of green manure each year. Depending on production conditions in these same areas, where production levels steadily improve and rise, the aforementioned system of one crop plus one green manure crop each year, or the system of three crops plus one green manure crop every 2 years can be gradually phased into a two crop system each year.

Development of hog raising is yet another major way in which to solve the fertilizer problem. A combination of farming and livestock raising should be practiced with active development of a collective livestock raising industry, diligent implementation of crop patterns for specialized fodders and crops from which fodder can be derived, and widespread development of intercropping and companion cropping to increase output of fodder. There should be raising of three waters and one duckweed and the growing of a collection of grasses for the opening of new sources of supply of fodder. Additionally is full use of the abundant resources within the region to collect and make diverse kinds of organic fertilizer, bacterial fertilizers and humic acid fertilizer.

(3) Equitable Arrangement of Crop Patterns for Paddy Rice Varieties

In order to assure the planting in the proper season of winter green manure and wheat following rice, the crop pattern for rice varieties should be early

ripening intermediate rice and intermediate ripening intermediate rice predominantly, and equitably matched with early, intermediate, and late crops. As a concrete example, generally 3 - 2:5:2-3 would be suitable, all areas making suitable readjustments on the basis of prevailing circumstances. In places where cultivated land area is large relative to available workforces where most communes and brigades farm a single crop, the proportion of early and medium maturing rice varieties could be increased "early rice following after early Chinese trumpet creeper," with the Chinese trumpet creeper being used as fertilizer for the rice. In communes and brigades with large workforces relative to available land, there should be more growing of medium and late maturing varieties to make full use of the increased output potential of medium and late ripening varieties. In actual crop patterns, attention must be given the growing of early, medium and late ripening varieties in separate tracts to facilitate care and to prevent a situation of conflict between the growing of wetland and dryland crops.

The proportions of xian and geng rice being grown are presentially substantially the same. Inasmuch as xian rice takes less fertilizer than geng rice and more readily produces high yields, under the present circumstances in which soil fertility is not high the growing of superior varieties, particularly varieties such as Nanjing No 11, and Zhenzhuai, which are early ripening high yielders, could be suitably increased. As soil fertility increases, a gradual change in the direction of growing mostly geng rice and hybrid rice could be made in the future.

2. Sensible Proportioning Between Grain and Economic Crops, Dryland and Wetland Crops to Build New Commodity Grain and Diversified Economic Crop Bases

The Xu-Huai region is the province's traditional dryland crop region. Since the conversion of drylands to wetlands, decline has occurred in the area on which autumn ripening dryland grain crops and some economic crops are grown, and in some places, the trend is toward continued decline in the growing of such crops. Consequently a very important question is how to adapt general methods to local situations to do sensible planning for grain and economic crop patterns, and wetland and dryland crop pattern so as to satisfy the many sided requirements of the national economy.

Reasonable planning of crop patterns means putting into effect "taking grain as the key link with all around development, adaptation of general methods to local situations, and appropriate concentration," doing overall planning with the needs of the state, regions, and the people's lives in mind, combining whatever benefits use and nurture of the soil, whatever favors balanced increases in yields and continued increases in yields of various crops, and whatever fully uses and turns to advantage existing production conditions and the basis for production, while at the same time favoring increasing yields and increased earnings. In terms of the Xu-Huai region this means proper handling of the proportional relationship between grain and economic crops, and wetland and dryland crops, grain crops, economic crops, green manure crops, and animal fodder crops thereby being sensibly planned for in an overall way to gradually build this area into a new commodity grain base and diversified economic crop base for Jiangsu Province.

First is the proportion of grain to economic crops. This region has been the province's multiple disaster, low yield, grain short region. Following the North China Agricultural Conference in 1970, conversion of drylands to wetlands was generally promoted throughout the region, while at the same time maintaining increased wheat yields plus steady increases in per unit yields of other dryland crops. This resulted in greatly increased output of grain, transforming the region from a longstanding grain-short area to one of virtual self-sufficiency, and beginning to provide the state with some commodity grain. Inasmuch as this region is one in which population is small compared to available land, and the one in the province in which the grain growing area is largest but yields per unit of area lowest, the potential for further increase in yields per unit of area, in total output, and the commodity rate is still fairly substantial. Consequently, an onslaught to increase yields per unit of area, total output, and to increase the commodity rate should be launched, the main goal being to build a new commodity grain base. This region is the province's major producer of economic crops such as peanuts, cotton, tobacco, and sugarbeets; however, the peanut and sugarbeet growing area has contracted during recent years, and the cotton growing area has not been stable either. In order to satisfy the province's and the region's needs for raw materials such as cotton, edible oil, tobacco, and sugar, to transform the single crop economy situation as rapidly as possible, to consolidate and strengthen the collective economy, and to constantly increase and enlarge commune member earnings, assured, equitable expansion of the economic crop growing area is necessary. Currently the economic crop growing area accounts for only 1.25 percent of the total cultivated area, and an all-around analysis of provincial and regional needs and capabilities shows that future expansion of the economic crop growing area to around 20 percent of the total cultivated land area would be sensible. Suitable expansion should be made in the area planted to cotton, peanuts, tobacco, sugarbeets, and hemp of various kinds. The place of rape in the crop system is good, and by using fields that lay fallow in winter and spring, rape could be vigorously developed. As part of overall planning, for the near future the area devoted to rape should not exceed five percent of the total area sown in autumn. In the cropping pattern, in addition to general development of rape in regions that have converted drylands to wetlands, all counties and communes should adapt general methods to local situations for the division of labor and relative concentration of other economic crops to establish commodity production bases. Ganyu, Donghai, the Xinyi hill region, and the sandy soil regions of Lianshui, and Huaiyin should be peanut bases. Feng, Pei, Tongshan, Suining, Siyang, Shuyang, and Xiangshui counties as well as coastal areas should be the focal points for the growing of cotton. Sugarbeet growing should be concentrated in areas around existing small sugarbeet processing plants to satisfy nearby needs. In order to assure steady development of economic crop production, conscientious study and implementation of pertinent economic policies and rational planning of crop patterns must be done so that commodity production will increase with each passing year.

Next is the proportions of wetland and dryland crops. Increase in yields of rice have been remarkable, as has been said previously. In terms of its land resources, this region devotes about 10 million mu of cultivated land to the growing of rice. This includes all of the lowland lake regions, and the silt soil, silt black soil, downlands black soil and heavily mottled alkaline soil

of plains areas. Not only do these soils produce higher yields of rice than of dryland grains, but generally good results have been attained in "changing the farming system to eliminate waterlogging," "growing of rice to change alkalinity," and improving low yield fields. It should be noted as well that some of this cultivated land is suitable for the growing of dryland crops. Silt soil, for example, has become the major producer in the province of soybeans, and with sensible crop rotation and fertilization, mottled alkaline soil makes a fine soil for the growing of cotton and sweet potatoes. How should these cultivated lands that are "suitable for dryland crops or wetland crops" be cropped in the future? This has to be done in terms of overall plans for crop patterns. At the present time, the rice growing area in the region total about 8 million mu, so how much should it be in the future? Apart from thinking about the adaptation of general methods to local situations, the main determinants are the following two factors. First is the water resources problem. As was previously said, this region's water resources are currently incapable of satisfying the needs of the existing rice growing area, and further expansion of the rice growing area would mean an even greater shortage of water resources. Even following the project for the northward diversion of waters from the south, the amount this region would get would be very much limited inasmuch as most of the water would go to satisfy the need for water in farming in North China. Furthermore, water is also needed in this region for the irrigation of dryland crops so as to assure continued high yields of dryland crops. Experience has shown that in water short areas, the irrigation required for one mu of rice would irrigate between 3 and 4 mu of dryland grain crops; the degree of increased output would be much greater than from 1 mu of rice, and yields per unit of area would not be lower than for rice either. When limited water resources are looked at in terms of rational economic use, there should be no plans for further expansion of dryland conversion to wetlands. Second is the matter of what position soybeans, corn, and sweet potatoes, which are the principal crops grown on drylands, should occupy in this region in the future. Before the conversion of drylands to wetlands in the Xu-Huai region, this was the province's main dryland grain crop area. The growing area for such crops occupied between 60 and 65 percent of total cultivated land. Following conversion of drylands to wetlands, a gradual cutback ensued until they came to occupy the present 43 percent or so of total cultivated area. How much should each occupy in the future? This also required concrete analysis. Historically this region has been the province's principal commodity soybean base. In 1953, the maximum soybean growing area reached more than 8.5 million mu for an output of more than 800 million jin. Following the conversion of drylands to wetlands, a dramatic decline occurred to an output totaling less than 400 million mu from 3.2 million mu in 1975. Despite their relatively low yields per unit of area, soybeans fill a proper place in the crop growing seasons, are able to nurture the land, and have broad uses. The masses have abundant experience in growing them too. As a result of the breeding of superior varieites and improvements in farming techniques, over the next 3 to 5 years it should be entirely possible to raise yields to the 250 - 300 jin per mu already obtainable from small areas. In order to satisfy the every increasing needs of the province for soybeans, in planning overall crop patterns, for the near term the soybean growing area should be maintained around 15 percent of the total area, i.e. at 3.6 million mu. The areas of distribution should be principally in Guannan, Shuyang, Xiangshui, and Lianshui

counties in the east, in Feng, Pei, Tongshan, and Suining counties in the west, and in Sihong County in the southwest. Corn and sweet potatoes enjoy wide use. They satisfy a need in the daily life of the people, and are an indispensable high yield crop for both farming and livestock raising. In recent years, with the use of rotational dryland and wetland farming, intercropping of green manure, and irrigation, increases in yields have been spectacular. An example was Ganyu County in 1975 where 310,000 mu of sweet potatoes produced yields (converted to dry weight) that exceeded the "target set for the region between the Huang He and the Chang Jiang" for a single season. In Suining County, somewhat more than 160,000 mu of corn produced yields of 473 jin per mu, exceeding both that county's and the entire region's average yields per mu of paddy rice. Yields from small plots of 1,000 jin per mu occurred everywhere. Thus, it may be seen that outputs of dryland crops are not only not low, but that a great potential for increased output exists. With future development of the livestock industry, requirements for corn and sweet potatoes will increase more and more. In full consideration of the potential for increases in yield per unit of area, the area devoted to them should be no lower than the present 30 percent of total cultivated land area. Figuring maintenance of the between three and four percent of total cultivated land area for the growing of lesser grains, the dryland grain growing area will amount to about 48 percent of the total cultivated area. At this rate, the future rice growing area will amount generally to about 32 percent of the total cultivated land area, i.e. it will remain at its current level of between 7.5 and 8 million mu.

In addition, equitable planning of the proportion of winter and autumn crops, with vigorous development of mostly wheat as the summer grain crop, is also a major way in which the building of new commodity grain bases can be done quickly. Summer grain (mostly wheat) is the crop most widely sown in this region, formerly occupying about 60 percent of the cultivated area. Since the conversion of drylands to wetlands, it has fallen to about 50 percent. But inasmuch as disasters to summer grain production are few, and inasmuch as drought and southwesterly dry winds, which posed the greatest threat, have been greatly ameliorated as a result of development of irrigation and construction of forest networks, both yields per unit of area and total output have tremendously increased, manifesting a huge potential for increased production. Take Xuzhou Prefecture as an example where in the 10 year period between 1969 and 1978 per unit yields and total output of wheat tripled. In 1978 wheat yields from 6 million mu averaged record yields of 315 jin per mu. In future summer grain production, in addition to continuing the onslaught to increase yields per unit of area, equitable plans must be drawn for a crop pattern of summer and autumn crop varieties. In expansion of the area grown to summer crops, proportions can be gradually increased to between 60 and 65 percent of the total cultivated area, with rotational cropping with green manure and rape in a system of two crops every 3 years for greater growing and greater income in order to increase the proportion of summer grain grown relative to total grain production, making fullest use of the potential of summer grain for increased output.

3. Active Improvement in Production Conditions With Steady Development of a Double Cropping System

Active development of a double cropping system is yet another important way in which this region can make full use of its soil and heat resources to increase agricultural production levels and build commodity grain bases and economic grain bases. In recent years, concurrent with conversion of drylands to wetlands and further tapping of the increased output potential of three crops every 2 years, has been development of a double cropping system of rice and wheat, a double cropping system for dryland crops, and a double cropping system of rotating wetland and dryland crops. The multiple crop index has grown from 1965's 150 percent to 1975's 175 percent, and the double cropping system area has risen from 10 percent of cultivated land to about 25 percent of cultivated land.

This region is located on the southern fringe of the temperate zone where heat resources can fully satisfy needs for development of a double cropping system. Since the Great Proletarian Cultural Revolution, great improvement and upgrading has taken place in the region's agricultural production conditions and levels of production, creating very good conditions for further increase in the soil utilization rate and all around development of the double cropping system. For example, great development of farmland water conservancy has greatly diminished flood, waterlogging, drought, and alkalinity disasters. The "change in system to eliminate waterlogging," in particular, with its large scale growing of rice to transform water from a disadvantage to an advantage, has powerfully transformed the former situation of adjustment to a situation of waterlogging and drought, avoidance of disasters to assure harvests, passive use of nature, and a fairly low multiple cropping index. As another example, the rapid development of the growing of green manure crops has changed the past backward method of nurturing the soil through winter fallow and summer raking to release inherent fertility to active nurturing of soil fertility through a combination of methods of use and nurture, strikingly improving both levels of fertilization and soil fertility. Consequently, active development of the double cropping system has become a major task for this region's future agricultural production.

(1) Active Creation of Conditions for Steady Transition

Development of a double cropping system requires active creation of conditions and diligent solution to the following several contradictions. (1) The contradiction between raising the multiple cropping index and inadequacy of fertilizer. As was said in the foregoing, in most parts of this region soil quality is presently rather poor, level of fertilization is not high, and for the practice of a double cropping system quantity of fertilizer used will have to be increased by between 30 and 50 percent. The fertilizer contradiction is very conspicuous. If one takes no account of realities, but attempts multiple cropping when only half prepared to do so, inevitably matters will not turn out as hoped and the goal of greater planting for greater earnings will not be realized. The Zhouxia Production Team in Dingju Commune, Suqian County had just such a lesson of experience. Subsequently, this production team accumulated fertilizer through a single crop of green manure and four raisings (hogs, cattle,

chickens, and rabbits), and from a foundation of steady increase in quantities of fertilizer (such as the quantity of fertilization of rice and wheat done in 1975 amounting to the equivalent of 27 jin and 52.5 jin of pure nitrogen respectively), was able to cut back on the amount of green manure grown, raise the multiple cropping index, and steadily develop a double cropping system. In recent years, grain yields have been more than 1,500 jin per mu. Suqian County's Gangyao Production Brigade made an all out effort on output of green manure and fresh grass producing three mu of it where it had formerly grown only one mu. It also raised hogs and accumulated the hog manure, and returned to the fields rice straw and the dried stems of rape. In Xinyi County, by sandwiching a crop of green manure between two grain crops, the Hongqi Production Brigade achieved the growing of an average more than half a mu of green manure for every mu of cultivated land, etc, providing valuable experience for solution of the afforestated contradiction. (2) The contradiction of hurried harvesting and planting seasons and a shortage of workforce. The average amount of cultivated land cared for by the workforce in this region cannot be termed too large; however, with the institution of a two crop system and the double rush to harvest and plant on time a lot of work is required, and in some places it is expected that workforces will not suffice, which may result in late harvesting and planting. Experiences have shown that this kind of contradiction may be solved through equitable planning of the order of cropping summer and autumn crops, with a staggering of the harvest and planting seasons, by increasing farm mechanization, and by matching early ripening varieties and varieties with a short growing season. (3) The contradiction in time and space caused by some crops that have long growing seasons. One example is the clearing of the fields of summer grown tubers, which impairs timely autumn sowing. When the time for sowing cotton is earlier than when summer crops ripen, difficulties ensue in following up with the cotton crop. The former problem may be solved through companion cropping of autumn sown crops or through planning of spring sown crops (spring barley or spring rape). Such was the case in Ganyu County where early ripening No 3 spring barley has been grown for the past 3 years for harvesting in early June, high yield plots yielding 830 jin per mu in a successful example. The latter contradiction may be ameliorated through companion cropping, and through transplanting of propagated seedlings. Experience has shown that widespread development of intercropping, companion cropping and active breeding of early ripening, high yield varieties with a short growing season are major ways in which to solve the contradictions in time and space in the practice of a double cropping system and in the partial development of a triple cropping system.

(2) Adaptation of General Methods to Local Situations in Equitable Arrangements For a Double Cropping System Centering Around Major Crops

There are quite a few kinds of double cropping systems, and choice of a specific one requires an equitably worked out crop pattern centering on the principal crops to be grown. On the basis of the requirement to build this region into a new grain base and a diversified economic crop base for the province, starting from the existing foundation in production future crop patterns will have to be mostly wheat, paddy rice, and cotton equitably matched to the growing of corn, soybeans, sweet potatoes, peanuts, sugarbeets, rape, and tobacco for the all around practice of a double cropping system of wheat

and rice forming two crops, with two dryland crops and the rotation of a wetland and a dryland crop. However, different places have different requirements.

(1) Two Crop Wheat and Rice Farming System in Lake Lowland Areas Type. Here paddy rice is currently dominant in a co-existing wetland and dryland system of three crops every 2 years. Principal crops are wheat, rice, soybeans, with dryland grain crops and economic crops being proportionately small. Historically, this region has been one of the province's major soybean producing areas. Henceforth, the orientation will be rice and wheat predominantly, maintenance of soybeans, and development of rape. In the crop rotation system, for the near term the area for growing of green manure as a single crop has to be expanded in the practice of three crops and one green manure crop every 2 years. The experiences of Huangchuan Commune in Donghai County in raising of duckweed in rice paddies, and of the Hongqi Production Brigade in Xinyi County in sandwiching a green manure crop between two grain crops are to be expanded, with development in the direction of rice and wheat (or rape) in a double cropping system each year with a crop of duckweed or transplanting of a crop of green manure being done, supplemented by the intercropping of a green manure crop with wheat and rice (or soybeans) in a wetland-dryland system of crop rotation. In saline lowland areas along the seacoast, the emphasis will be on a double cropping system of transition of rice, wheat and cotton, rotating between wetland and dryland, this type thereby developing into a newly established rice, wheat, and rapid base while maintaining traditional soybean production.

The Suining County Type of Rotating Two Crops on Wetlands and Drylands on the Eastern Plains Area, Giving Equal Emphasis to a Double Cropping System of Rice and Wheat.

Right now a triple cropping system that gives equal emphasis to wetlands and drylands predominates. Kinds of crops are numerous, and the ratio of economic crops is large. The farming system is complex. Cotton, sugarbeets and peanuts hold important positions within the region. Future orientation is suitable expansion of the rice, wheat, cotton, and rape growing area, with emphasis going to assuring the growing of more peanuts and sugarbeets, appropriately cutting back the area devoted to corn and sweet potatoes for development in the direction of a double cropping system of rice and wheat (or rape) each year, and rotation of two crops between wetlands and drylands, equal emphasis going to grain, oil-bearing crops, and cotton. Active promotion has to be given the experiences of Gangyao Production Brigade in its vigorous endeavors to grow green manure and fresh grass, and of the major efforts made by Siyang County to grow green manure all year round; to increasing the use and nurture of the land through a crop rotation system, with subsequent development in the direction of the year round growing of green manure; the growing of green manure in the "10 besides;" and the growing of aquatic green manure, all being given equal emphasis. Starting with the tapping of potential for increased yields through a double cropping system, some communes and brigades can try out development of five crops every 2 years or three crops every year by using intercropping and companion cropping to build major grain and economic crop bases in this region.

(3) The Hill and Downlands Type of Two Dryland Crops and Two Crops Rotated on Wetlands and Drylands, Each Receiving Equal Emphasis. At the present time, the system of three dryland crops every 2 years predominates along with other double cropping methods. Principal crops are wheat, sweet potatoes, corn, paddy rice, peanuts, and various kinds of pulses. Future orientation will be toward appropriate expansion of the wheat, peanut, and pulse growing area, and cutbacks in some of the rice growing area with development of some rape for development mostly of two dryland crops and rotation of two crops between wetland and dryland, with some places in which water resources are good developing a double cropping system of rice and wheat (or rape). In the northeastern hill and mountain area, in addition to emphasis on development of a double cropping dryland system of wheat and sweet potatoes (or peanuts), active promotion should be given the experiences of Ganyu County in its double cropping system of rotating between wetlands and drylands for the growing of grain and oil-bearing crops (peanuts) to build a consolidated peanut base for the province. In the southwestern Sihong County downlands, development will be principally in the direction of two crops of wheat and pulses (or corn), or wheat and cotton (or tobacco), and of paddy rice and pulses (or corn), and wheat (or rape) in a double cropping system of rotation between wetlands and drylands in vigorous improvement in the commodity rate for wheat, barley, and naked barley, pulses, and tobacco. For the near term, as part of the rotational cropping system vigorous efforts must be devoted to development of the growing of green manure as a single crop and making full use of the "10 besides" for the growing of green manure, with a transition in the direction of growing green manure all year round and in the "10 besides."

(4) The Two Dryland Crop Type of the Feng, Pei, Tongshan, and Suining County Plains and the Flatlands of the Old Bed of the Huang He. Today the farming system is one of the three dryland crops every 2 years, with equal emphasis on grain and economic crops. Principal crops are wheat, corn, soybeans, cotton, sugarbeets, and cotton. The future direction is equal emphasis on grain and economic crops in a two dryland crop system predominantly, with the crop pattern appropriately enlarged for wheat, corn, and soybeans, with cotton maintained, but with rice cut back and emphasis given to the growing of tobacco and sugarbeets. Active promotion will be given the experiences of Suining County in its major efforts in the growing of green manure all year round in conjunction with development of the growing of green manure in the "10 besides," and the widespread development of intercropping, companion cropping, and transplanting, using the present system of three dryland crops and one green manure crop each year to develop in the direction of two dryland crops each year of wheat and corn (or soybeans), or wheat and cotton, with intercropping, companion cropping, or transplanting during one season of green manure, or else growing green manure in two seasons.

Fourth Section. Development of Economic Diversification Featuring Forestry and Livestock Raising

Though a certain foundation for economic diversification exists in the Xu-Huai Region, it remains a weak link in agricultural diversification. In 1975, income from economic diversification for the entire region amounted to only 14 percent of total income. This region abounds in natural and soil resources,

and potential for economic diversification is very large. Use of sideline occupations to advance agriculture in a combination of agriculture and sideline occupations for all around improvement in large scale socialist agriculture is an extremely important task.

1. Vigorous Promotion of Forestry; Consolidation of the Development of Fruit Orchards; and Active Development of Silkworm Mulberry Production

(1) The foundation for forestry in this region is fairly poor, both the tree growing area and timber reserves being slight, forests being of a single kind, and distribution forests uneven. In 1975 the region had a total of 1.39 million mu of forestlands accounting for 2.7 percent of total land area and 27.4 percent of the forested area of the province. Of this total, somewhat more than 80 percent were timber forests, their distribution being concentrated in the Yuntai Mountains, the Maling Mountains, and the Xiang Mountains, all of which are low mountains and hills, as well as on some large and medium size river dikes. Shelter forests account for 15 percent of the total, and they were mostly distributed along the shore of the Dasha He, the old bed of the Huang He, the Shu He, and the Hongze Lake. Other large areas included mostly afforestation of the four besides, with an average 40 trees per person. Timber forest reserves for the region totaled 5.8 million cubic meters, an average per capita of 0.38 cubic meters, 80 percent of which were reserves in the four besides. Aside from small areas of pine and fir in the Yuntai Mountains, most tree varieties are Chinese scholar trees, elms, poplars, and willows. For example, in Xuzhou Prefecture, timber forests contain 56 percent scholar trees, 23 percent poplars and willows, and 16 percent pines, superior varieties of other trees being very few. At the same time, however, because of poor management and slow forest growth, the average annual net growth of forest tracts in Xuzhou Prefecture is only 0.07 cubic meters.

Considering the large needs of this region for timber used in agriculture and mining, the heavy requirements for shelter forests for farmlands and fruit orchards, and prevention of soil erosion as well as meeting needs for war preparations, future forestry development will require all around planning, strengthening of leadership and full, rational use of the vast soil resources, while vigorously protecting and improving existing forest resources. It will require the planting of trees for the afforestation of low mountains and hills carried out in concert with afforestation of plains, combining capital construction of farmlands with the building of farmlands forest networks. Maintenance of collective afforestation will be paramount, with active development of state afforestation augmented by encouragement to commune members to grow trees in front of their homes. In accordance with the principle of the right trees for the right land, and through combining trees and bushes, vigorous development will be given the growing of timber forests and forests for use as mine props, meaning pine, cypress, locusts, and fir (metasequoia), intensification of the building of shelter forests of mostly poplar, willow, chinaberry, and the "three strips," (latiao [5248 2742], Salix sino-purpurea, and false indigo), and the afforestation of the four besides mostly with locusts, mulberry, elm, willow, poplar, fir, bamboo (both dan bamboo and gang bamboo), paulownia, and chinaberry.

1. Consolidation and improvement in output of timber and mine props from the low mountains and hills of the Yuntai Mountains (including Ganyu), the Maling Mountains, and the Xiang Mountains, with vigorous development of large scale lake and river bank, timber output at Hongze Lake, Luoma Lake, and along the Huai, the Yi, the Shu, and the Si rivers. A look in terms of conditions of local growth and production characteristics in all places shows the mass of the Yuntai Mountains to be rather large, the soil layer rather thick, fertility rather high, the climate warm and moist suitable for the growing of large tracts of timber forests. This region is close to fishery production bases, and account should be taken of the needs for timber of the fishing industry. Future care must be improved, wanton cutting strictly prohibited; there must be steady transformation of the purely Japanese red pine forests to stands of mixed pine and deciduous forests; continued building of mixed forest stands of black Japanese pine, locust, sawtooth oak, maple, Chinese catalpa and, where terrain and microclimate permit, some development of cishan [0459 2619] [possibly a variety of juniper], moso bamboo, and tea plants. The Maling mountain and hill region is not very extensive; soil is relatively poor, and mucky soil that is prone to drying out and to waterlogging is fairly abundant. This area does not favor forest growth, and stunted trees are likely to develop. Most important tree varieties are locusts, poplars, willows, maple, tree of heaven, chinaberry and the "three strips." Right now the conflict between forests and grain and forests and livestock is rather pronounced, and capital construction for forestry production is rather poor. The future requires satisfactory solution to the conflict between forestry and the growing of grain and between forestry and the raising of livestock, and a prohibition against destruction of forests to plant grain. Efforts must be made to change local conditions of forest growth, and improvements in stunted old trees and sparse woods accelerated. Japanese black pine, oriental arborvitae, locust, tree of heaven, Chinese pistache, and such superior variety trees should be developed. The Xiang Mountain low mountain and hill region is a mass that sits off by itself. Its soil layer is poor and erosion is fairly serious. Today no clear system exists for forestry production there; growth of tree tracts is poor, but the barren mountain area is large. In future, planning should be intensified, a system defined, and active measures taken to plant forests to halt erosion, selecting oriental arborvitae, locusts, tree of heaven, and chinaberry for all around afforestation of barren hills. Care and management of existing trees should be intensified in order to satisfy as quickly as possible this area's needs for timber used in mining and in agriculture. The large dikes of the Hongze Lake, Luoma Lake, the Huai and the Shu rivers, the Grand Canal, Yi He, and the Pei and the Hong rivers total an area of more than 100,000 mu, the surface of which is flat, the soil layer thick, and the soil fertile, making them extremely appropriate for the growth of forests. Some of them have already been afforested, but the work has not been fully rational, tree varieties are jumbled, some have become old, and accumulated timber reserves are low. A large amount of dikes still remain for use. In future, maintenance of the soil against erosion must be combined with full, rational use of the dikes so long as their function in prevention of floods is not impaired, to replace the existing mixture of trees and vigorously develop timber forests.

Continued strengthening of the building of the broad plains area's farmlands, fruit orchards, shelter forests, and soil preservation forests at rivers, lakes, and reservoirs. A foundation of shelter forests and erosion prevention forests already exists; however, it far from meets the needs of consistently high yields in farming and the growing of fruit. Henceforth there must be continued building of farm and fruit orchard shelter forests on the Huang He flood plain, while at the same time actively building coastal shelter forests to block the wind, block windblown sand, and help improve the saline-alkaline soil, and to meet war preparation needs and some local needs for lumber. There must be active care and management of forests that maintain the soil against erosion along rivers, lakes, and reservoirs with promotion of forest growth.

3. Broad development of afforestation of the four besides in an effort to solve local timber needs. In recent years in the Xu-Huai Region a large number of advanced afforestation units have cropped up and have accumulated abundant experiences. For example, Shuyang County is already virtually forest networked and timber reserves average 0.5 cubic meters per capita. It has preliminarily attained self-sufficiency in the "three timbers" (timber for farm use, timber for living, and timber for firewood. Paoche Commune in Xinyi County has afforested an average 120 trees per capita to achieve use of forests to promote the growing of grain in a combination of forestry and farming in which the forests are luxuriant and grain abundant. Gengji Commune in Tongshan County has worked arduously for 3 years to afforest ditches, canals, roads, and forests as well as the four besides for an average 120 trees per capita. Heqiao Commune in Tongshan County has practiced the intercropping of grain and tung trees (paulownia) to win bumper harvests of both grain and forests. This fully shows a very great potential for afforestation of the four besides in this region. In order to meet war preparation needs and satisfy local requirements for the "three timbers" as soon as possible, farmland capital construction must be combined with forest building. On the basis of the principle of unified planning for mountains, waters, fields, roads, and forests, tackling them in a comprehensive way, there should be adaptation of general methods to local situations for the selection of fine variety quick growing trees such as mulberry, locust, elm, willow, metasequoia, and paulownia, and of dan and gang bamboo, wideranging afforestation of the four besides, vigorous growing or improvement in the growing of trees along provincial and county roads, planned step by step planting or renewal of plantings of forest trees along main irrigation channels and branches, conversion of river dikes into forest belts, farmlands into forest networks, roads into areas shaded by trees, and villages into forest farms in order to turn the good earth of the country into a park.

(2) Consolidation and Development of Fruit Tree Forests

This region has a long history in the cultivation of fruit orchards, which are among the oldest in the province. Very great development of fruit orchard industry production has taken place since Liberation. In 1975 the region's fruit orchards totaled 340,000 mu, or about 60 percent of the area devoted to fruit orchards in the province. Initially established are the fruit production base of the old bed of the Huang He where mostly apples, pears, and grapes are grown, and the dry fruit production base in the Maling Mountains, where mostly Chinese chestnuts, and dates are grown.

Principal problems in fruit forest production today are as follows: 1. Unevenness in production. Regional distribution is concentrated in the old bed of the Huang He and the sandy soil plains areas, with very few fruit trees in the vast silt soil plains. Proportionally, juicy fruits are more numerous than dry fruits, dry fruits being very few. In Xuzhou Prefecture, the area devoted to juicy fruits is calculated as being 92 percent of the total fruit orchard area, and this makes for uneveness in supply of output. 2. Yields per unit of area are low, averaging only somewhat more than 200 jin per mu. Reasons are: First, in many orchards, particularly in collective orchards, fruit tree care is backward. Second, in most fruit orchards capital construction is rather poor. Collective orchards generally give very little attention to the planting of shelter forests. Numerous collective orchards have yet to build complete drainage and irrigation systems. Drainage is bad and water stagnation a serious problem. Additionally, numerous orchards lack pesticides, and technical management does not keep pace. However, some advanced models of fruit production have also appeared in this region. The Shihu Orchard in Lianshui County, for example, made major efforts in capital construction of fruit production, placing fertilization in a commanding position. They intensified technical management to assure high yields of finest quality fruit, in 1974 producing yields averaging more than 1,700 jin per mu. The Tiao He Orchard in Shuyang County emphasized deep plowing to improve the soil, grew green manure, and prevented and controlled diseases and insect pests as measures of technical control, producing in 1974 fruit yields of more than 2,000 jin per mu. It may be seen that this region holds very great potential for development of fruit production.

The future course and methods of development are as follows: 1. Consolidation and improvement in fruit output. Natural conditions in the Xu-Huai Region are best suited to the growing of apples, pears, and grapes for the most part, and a substantial area of fruit orchards already exists. In order to satisfactorily solve the conflict between the growing of fruit and the growing of grain and to further tap potential for orchard production, future fruit production must emphasize consolidation and improvement. Capital construction of fruit orchards must be taken firmly in hand, technical management intensified, green manure widely planted, and superior varieties gradually replacing existing ones in an effort to increase yields per unit of area. 2. Active development of dry fruit output. The dry fruit area is currently small and output low. The dry fruit area for the entire region totals 27,000 mu, or eight percent of the total orchard area. In 1975 output totaled 800,000 jin, or yields averaging 30 jin per mu. In order to change the imbalance between juicy fruit and dry fruit production, and particularly in order to meet the needs of war preparation, dry fruit production must be actively developed. In the Sihong downlands are fairly large areas of barren mountains and hilly downlands suitable for the growing of Chinese chestnuts and dates. This area also possesses a tradition in their production and could become a major growing area. At the same time this should be linked to the greening of the four besides in a vigorous effort to develop dry fruit production to get both fruit and timber for use.

(3) Active Development of Silkworm Mulberry Production

Silkworm mulberry production has long been a major rural sideline occupation of this region. In 1975 the area had a total of 90,000 mu of mulberry groves and produced somewhat more than 40,000 dan of cocoons accounting for 12 percent and 8 percent respectively of total production in the province. Potential for further development is large. Principal problems in silkworm mulberry production today are as follows: 1. Development is very unbalanced throughout the region. Tracts of lake [3275] mulberry in the region total somewhat more than 80,000 mu, and tree [0829] mulberry trees number more than 800,000, most of these concentrated in the sandy soil of the Huang He flood plain, little of it being in the silt soil area. 2. Silkworm mulberry production levels are low. In 1975, cocoon yields averaged somewhat more than 40 jin per tray of silkworms, each mu of lake mulberry producing only 250 to 300 jin of leaves. 3. Spring is the major silkworm raising season, the proportion grown in summer and autumn being relatively small. Historically spring silkworms have generally accounted for more than 50 percent of the total quantity grown, summer silkworms accounting for about 8 percent, and four autumn silkworm yields totaling between 35 and 40 percent.

In order to actively develop silkworm mulberry production, it is necessary to further consolidate and improve existing mulberry groves, make efforts to improve yields per unit of area, and develop new groves in a planned way. 1. Growing of a combination of lake and tree mulberry, lake mulberry predominating. Management of lake mulberry tracts has to be taken firmly in hand to raise yields per unit of area. In addition, full use may be made of medium and small river embankments and embankments along main irrigation canals to develop some new mulberry groves. Both the leaves and the wood from tree mulberry may be used. Currently some communes and brigades are planting tree mulberry along main roads and on both sides of main and branch irrigation canals and ditches, and this method may be promoted through adaptation of the general method to local situations together with improvement in care and replacement to increase yields of leaves. 2. Major emphasis on the raising of spring and autumn silkworms, but appropriate emphasis on the raising of summer silkworms too. In spring and fall temperatures are just right and the supply of leaves is copious; however, when raising silkworms in the fall attention must be given to protection of branches and buds of mulberry trees and to guarding against excessive use of leaves that might impair the following year's growth. In summer, temperatures are high and humidity great. Silkworms become prone to disease. Under present conditions, however, general methods may be adapted to local situations for appropriate increase in the proportion of summer silkworms grown. 3. Improvement in silkworm production management and administration, doing a good job in drainage of providing mulberry grove drainage facilities, eliminating waterlogging, and increasing fertilization. Vigorous promotion must be given new techniques for raising silkworms, with gradual improvements in silkworm growing areas and implements used in the growing of silkworms so as to assure steady development of silkworm raising endeavors.

2. Accelerated Development of Livestock Industry Production, Principally the Hog Raising Industry

In this region, a livestock industry centering on the raising of hogs has historically been a production sector closely linked to farming. In recent years output value from the livestock industry has amounted to between 12 and 15 percent of total output value from agriculture, and every year a certain quantity of live hogs and poultry eggs are supplied the state. However, the current speed of development of the livestock industry is slow and production uneven. It is unable to meet needs of agricultural development and the ever increasing requirements of the state for the livestock industry. In 1975 the region raised 5.73 million hogs for an average of 22 live hogs per 100 mu of cultivated land, far from the requirement of "one person, one hog; one mu, one hog." In terms of regional distribution, hog raising is concentrated on the sandy soil plains and along the hilly northeast region. An estimated 70 percent of the region's hogs are raised in these areas where live hogs average 30 head per 100 mu of cultivated land (the largest number being in Ganyu County where they average 50 head per 100 mu). Fewest are raised in Sihong, Feng, and Pei counties, an average of only 17 head per 100 mu. The proportion of collectively raised hogs is small and constitutes yet another aspect of the imbalance in hog raising. In 1975, 1.68 million hogs were collectively raised in the region accounting for only 27 percent of the total number of live hogs. Even today some production teams do not collectively raise hogs.

Development of large livestock animals has not been rapid either and the burden on available draft animals is rather heavy, each head of oxen being required to work an average of more than 40 mu. Fairly great development has occurred in recent years in the raising of sheep and goats, but the potential is still great.

An economy with no livestock industry is an incomplete national economy. In future, full use must be made of this region's favorable natural resources and of existing production bases for further building of major production bases for live hogs, cattle that may be used as both draft animals and for meat, and fine haired sheep and goats.

(1) Vigorous Development of the Hog Raising Industry

Chairman Mao's instruction on "much raising and special emphasis on raising of hogs" must be firmly adhered to in diligent implementation of "active development of collective hog raising and continued encouragement to commune members to raise hogs," striving to promote superior hog varieties (Xinhuai hogs, and Yorkshires), and while working for general development of hog raising to further develop commodity hog production on sandy plains and in hilly downlands.

The key to doing a good job in the hog raising industry is energetic development of collective hog raising and genuine solution to feed problems. Commune and brigade collective hog raising farms with definite hog raising quotas must be established, and they must be gradually mechanized or semi-mechanized for the raising of pigs to accelerate and bring into full play the guiding role of collective hog raising in the hog raising industry. Special attention

should be given development and breeding of superior varieties of sows in a practice of using local superior varieties of sows and male hogs introduced from elsewhere for the economic hybridization of meat hogs. The Xinhuai hog is a superior variety hog from Huaiyin Prefecture that grows rapidly and tolerates coarse feed. Collective forces must be relied upon for areawide breeding of Xinhuai hogs, and in Huaiyin and Suqian counties, where conditions are good, Xinhuai hog breeding bases should be established. In addition to vigorously spreading the local superior Xuhai breed of hog, Xuzhou Prefecture should continue the acclimitization and improvement of superior breed Yorkshire and Berkshire hogs, establishing breeding bases in Ganyu and Donghai counties to fully meet local needs for superior breeds of hogs.

In the Xu-Huai Region land resources are abundant, and the wetland and dryland cultivated area is large; there are numerous kinds of agricultural sideline products, and fodder sources are extremely broad. Nevertheless, problems still exist today in insufficient quantity, poor quality, improper methods of use, and uneveness in year round supply of hog feed. Consequently, the masses should be fully aroused to use multiple methods of growing, raising, collecting, storing and processing in a major effort at hog feed production and the establishment of stable fodder bases. Active promotion should be given advanced experiences in grinding, pulping, fermentation, and green storage so that green fodder will be available all year round, the green fodder being used in concentrated feeds in a combination of green fodder, coarse fodder, and concentrated feeds green fodder predominating.* Major efforts in green fodder: Experiences of Huangchuan Commune in Donghai County and of Wangji Commune in Guanyun County show a need, first to grow green fodder; second, to breed "three waters," third, to cut green grasses, scoop water plants from water surfaces, and collective tree leaves. Depending on the number of hogs they grow, collective hog raising farms must establish a commensurate number of fodder bases and make full use of the slopes of ditches, open spaces, ridges between fields,and water surfaces, adapting general methods to local conditions for the growing of alfalfa, carrots, purslane, Symphytum officinale, broad beans, rape, Chinese trumpet creeper, pumpkins, sesbania, false hemp, and the growing of "three waters and one duckweed." Widening sources of coarse feeds: The experiences of Zizhuang Commune in Tongshan County, of Dingju Commune in Suqian County, and of Yunhe Commune in Xiangshui County may be promoted for the wideranging collection and processing of paddy rice husks, tree leaves, weeds, and the stalks, stems, vines and leaves of all kinds of farm crops. Active efforts in storage of green fodder: The experiences of Yinshan Brigade in Zhaxia Commune, Shuyang County and of Paoche Commune in Xinyi County in the use of underground storage on high ground of green fodders such as sweet potato vines, "three waters," carrots, grass and leaves, all merit promotion. Guaranteed supply of a certain amount of concentrated feed: The concentrated feeds needed in the raising of hogs may be fully supplied through suitable increases in withholdings of stipulated amounts of feed grain

*Experiences of No 6 Production Team of Qunxing Production Brigade, Jiepai Commune in Binhai County show it is equally possible to raise fine hogs on a mixture of 70 percent green fodder, 20 percent dry, coarse fodder, and 10 percent concentrated feed.

from increased output, and from sideline products returned from processing by the "five mills" [0063 0972].

(2) All Around Development of Cattle, Sheep, Goat and Poultry Raising

For many years growth in large domestic animals such as plow oxen has been slow in this region, and unable to satisfy the needs of production and livelihood. In future large Xuzhou oxen and Haizi oxen must be improved and developed for gradual development in the direction of cattle that can be used both as draft animals and for meat, and for milk and meat. Simultaneous with general development can be development of a cattle raising industry emphasizing development of cattle useful both as draft animals and to provide meat in places where a rather good foundation already exists such as Feng, Pei, Tongshan, and Pi counties, and places where rather good conditions for breeding exist in Sihong, Shuyang, Guanyun, and Binhai counties. There should be further improvement in fine haired sheep and goats to produce, over a period of time, a superior breed of Xuzhou fine haired sheep and goats. There may be actively developed in the good existing bases of Eeng, Pei, Tongshan, and Xin'an, counties and in eastern coastal areas. Goats tolerate coarse fodder, and sources of fodder for them are widespread. They are easy to raise, and bring quick returns, so development should be in the direction of animals that provide a combination of meat and hair. In addition, communes and brigades having suitable conditions should be aroused to collective raising of chickens, geese, ducks, and rabbits, and commune members should also be encouraged to raise sheep and goats, rabbits, and poultry for all around development in the livestock industry. In the rabbit raising industry, in particular, potential is very large and should be given special emphasis.

3. Full Use of Waterland Resources for Development of Fishing Industry Production

The basic situation today in the Xu-Huai Region's fishing industry production is as follows: Development of hatching on inland water surfaces has been rather rapid; however, utilization is not complete and outputs are low. In the marine fishing industry, small catches in coastal waters predominate, and open sea production and utilization of sea beaches are still weak links. In 1975 the region raised freshwater fish on 550,000 mu, which was 55 percent of total water surfaces used for fish raising. Fishery industry output totaled 45,000 tons, or about 15 percent that of the whole province. More than 90 percent of this total was achieved through fishing, the proportion obtained from breeding being very small. Yields from freshwater hatching average only about 30 jin per mu, mostly from ponds in Tongshan, Pi, Suqian, and Siyang counties. The large water surfaces provided by Hongze Lake, Luoma Lake, and the Shiliang He Reservoir are, with the exception of Hongze Hu where a good foundation exists for a fishing industry, under utilized for the catching or breeding of fish. Reasons for low output in the fishing industry and less than full use of resources are as follows: 1. Capital construction of freshwater breeding water surfaces is very poor. Most ponds and ditches are in a state of being dried up (or flooded), too small, too shallow, stagnant, or lacking nutrients, and plans are lacking for their transformation and management. 2. Insufficient attention is given the breeding and protection of

aquatic product resources. In Hongze Lake, for example, following the construction of locks, channels for the fish to swim in were cut off, so the number of fish returning to spawn were reduced. Quantity of water stored in the lake has increased, growing lakeshore aquatic plants and doing a certain amount of damage to spawning grounds for fish that live there. In recent years Hongze Hu has sustained severe pollution causing a great decline in the types of fish resources there. Marine fishing industry resources have also begun to deteriorate as a result of the large catches of spawning schools and reckless taking of small fish. 3. Level of mechanization of the fishing industry is low. Ocean fishing, in particular, depends largely on wooden junks and mechanized junks, very few mechanized fishing boats being used. This hurts the open sea fishing industry. Furthermore, refrigerated procurement ships and oilers are lacking to the impairment of increase in fishery industry output.

In future, the fishing industry will have to fully utilize the many kinds of inland and marine water surfaces as well as the vast beach resources to develop both freshwater and marine fishing and breeding simultaneously for all around development of catching, hatching, and growing of aquatic products. Actual patterns and methods of development are as follows: (1) Full use of large water surfaces such as Hongze Lake, Luoma Lake, and the Shiliang He Reservoir to build major freshwater fishing industry production bases for the entire region (or entire province). These large bodies of water are large in area, abundant in nutrients, and food for fish is abundant. In addition, resources are abundant both for freshwater catches and hatching. There is need today for the breeding and protection of fishing industry resources. When locks are built, provision must be made for fishways to increase the kinds of fish returning to spawn and prevent loss of fish types. Locks should be opened regularly to allow fry to pass. Waters should be stocked mostly with black carp, grass carp, silver carp, flatheads, and crabs, and times and places for no fishing should be set, and certain equipment prohibited whenever and wherever different kinds of fish are spawning so as both to protect the parent fish and the breeding of succeeding generations, and to promote increased breeding of fishery industry resources in lakes and reservoirs. There should be further organization of fishermen to take up fixed abodes and engage in a combination of breeding and catching of fish in which breeding predominates. (2) Full use of ponds, streams, and irrigation channels for the scientific breeding of fish with vigorous promotion of experiences in the raising of high yields of quality fish and efforts to develop freshwater fishing industry hatching primarily for self-sufficiency within the region. This region has a large area of ponds, rivers, streams, and canals. These water surfaces are near places where people live; water quality is good, and various kinds of fish food are ample, making possible the raising of numerous kinds of fish and the growing of aquatic plants in shallow water. The collective forces of communes and brigades should be put to full use for a combination of water conservancy construction and collection of fertilizer, with capital construction of fish ponds, building of fish ponds with consistently high yields, building of fish food bases, adaptation of general methods to local waters for sensible raising of fish, dense raising of fish, and intensive raising of fish to increase output of fish grown in internal water surfaces. (3) Vigorous development of sea beaches and fish raising in inshore areas. This region has a wide expanse of sea beaches where the terrain slopes gently, where inshore water surfaces

are vast, where waters are shallow and tides gentle, where numerous streams flow into the sea, where waters teem with nutrients, and where plankton abounds. Above the median tide line, the soil consists primarily of oily sludge. At the median tide line and below the medium tide line, soil is mostly fine sand of use in development of beach and inshore hatcheries. Lianyungang, Yanweigang and Ganyu currently have a small amount of algae, mollusk, fish and shrimp raising. In the future, full use can be made of the existing foundation for active development in the area of Qinshan Island to the north of Haizhou Bay of an algae and prawn raising area. At the same time production of mussels, oysters, and shrimp may be intensified at Lianyungang, Yanweigang, and Erzenggang. Other places can adapt general methods to local situation for development of the hatching of mullet, qun [?], perch, conger pike, and shrimp. In order to enlarge the breeding area and increase output, further survey of sea beaches and inshore fishing industry resources is required, with all around planning and sensible distribution. On coastal flats where hatching is already underway, capital construction should be undertaken in an effort to increase quantities hatched. (4) Further development of modernized fishery production bases at Lianyungang and Yanweigang for expansion of marine catches. Lianyun gang and Yanweigang are near Haizhou Bay and the Kaishan fishing grounds. The harbors are wide, waters deep, and waves small, benefiting the plying back and forth of fishing boats, avoiding winds as they operate. Along the seacoast fishing resources abound, mostly large and small croakers, hairtails, cuttlefish, mullet, qun [?], perch, anchovies, Spanish mackerel, conger pike, shrimp, and crabs. In future it will be necessary to breed and protect marine fishing industry resources on the one hand and to hasten construction of fishing ports such as Lianyungang and Yanweigang on the other, vigorously develop powered marine fishing boats, increase refrigerated storage facilities, drying, and processing facilities, steadily increase mechanization of the fishing industry, and gradually expand marine fishing, making these places into some of the province's major modernized marine fishing bases.

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CHAPTER 9. LAKE TAI AGRICULTURAL REGION

Nanjing JIANGSU NONGYE DILI [AGRICULTURAL GEOGRAPHY OF JIANGSU] in Chinese Jun 79 pp 166-182

[Text] First Section. Survey and Characteristics

The Lake Tai agricultural region is located in the southeastern part of Jiangsu Province. It is bordered on the north and northeast by the Chang Jiang, Zhangjiagang [River] and Yantie Tang and the area along the Chang Jiang. To the west and southwest it is bordered by the Zhenyang hill region along an elevation line basically 10 meters high. The land area of the region totals 14,979 square kilometers (or 22.47 million mu), accounting for 14.6 percent of the province. Farm population numbers 8.2 million or 16.6 percent of the total in the province. Cultivated land area is 10.23 million mu, or 14.7 percent of the total in the province, for an average of 1.25 mu of cultivated land per capita of agricultural population.

This region is located in the southern part of the north sub-tropical zone where heat conditions are good, annual temperatures averaging between 15 and 16°C, and where accumulated temperature stabilized at 3°C ranges from 5,300 to 5,640°C. As compared with other regions in the province, the warmth of spring returns early and autumn temperatures drop late. The winter season is fairly warm. The frost free period is from 220 to 240 days, the crop growing season being rather long. Quantity of rainfall is copious, averaging between 1,000 and 1,100 millimeters most years. Rainfall during June to September accounts for between 40 and 55 percent of the annual total, and fluctuations from one year to another are more stable than in other regions. Sunshine in normal years averages between 2,000 and 2,200 hours, sunshine in summer and autumn being copious to the benefit of growth of autumn ripening crops. Between July and September, however, the region is affected by, or damaged by, typhoons.

This region is part of the Chang Jiang delta; its topography is flat with a gentle tilt from west to east. To the northwest and north lay the Meng He and the Wucheng high plain with an absolute height of from 5 to 7 meters. To the southwest between the Tao Lake and Ge Lake lies the Ge high plain with an absolute height of 6 to 10 meters. To the northeast lies the Yangcheng Lake lowlands plain with an absolute altitude of from 3 to 4 meters. To the southeast lies the Dianmao marsh plain with an absolute altitude of 3 to 5 meters. In addition, along the shores of Lake Tai are some small hills. As a result of differences in topography and the uses to which man has put the land, there are high flat fields, flat fields, lowland fields, marshy fields, and hill drylands or woodlands.

Within the region, lakes and streams intersect to form a network, and in the center is the 2,250 square kilometer Lake Tai, which is linked to numerous marshes and rivers and has a great storage capacity. Waters entering Lake Tai come from the three water systems of Tiao Xi, Nan Xi, and the Grand Canal. The lake discharges water principally into the Huangpu Jiang but also into 11 low-lying bodies of water such as the Liu He, Baomao Tang, Wangyu He, and through 20 waterways into the Chang Jiang. Water sources for irrigation are abundant; a foundation exists and conditions are good for large and medium size master water conservancy projects; and this plus virtually complete electromechanical pumping for irrigation and drainage means that, except for a few high or low-lying areas, harvests may be assured despite waterlogging or drought.

The natural soil is yellow-brown soil, which is mostly distributed over a not very large area in the hills that surround Lake Tai. Agricultural soils are mostly rice paddy soil, the mother material for which was alluvium and lacustrine deposits with fairly high natural fertility and which, as a result of nurture by man over a long period of time, has been turned into a wide expanse of fertile soil. Various kinds of paddy soils include mostly yellow submergic soil. It is found mostly in the high plain region of the Meng He where it is mixed with jiasha soil [1140 3097 0960] and goutou soil [3699 7333 0960]. In the level field region, the soils are mostly a mixture of black hill soil [3527 1472 0960] and belozem. In the marshy field region, there is little yellow submergic soil, but rather mostly blue mud mixed with grass stubble soil. High yield soils include shanxue [7668 5877] yellow submergic soil, yellow submergic soil, and shanxue belozem accounting for about 60 percent of the total. Moderate yield soils include black hill soil and shutou [4549 7333] yellow submergic soil accounting for about 25 percent. Low yield soils include belozem, blue purple mud, blue mud, shutou [4549 7333] black hill soil, grass stubble soil, and goutou sand [3699 7333 3097], which account for less than 15 percent.

Agricultural production in this region has long been principally rice and wheat. Output levels are fairly high and consistent. Following Liberation, grain output steadily climbed. Accompanying the steady and thoroughgoing campaign to emulate Dazhai in agriculture, much capital construction of farmlands was done, and the farming system was restructured, with practice of scientific farming. Beginning in 1964, grain yields per mu exceeded targets of the "National Program," and beginning in 1968 they were over 1,000 jin. Statistics from Suzhou Prefecture show that in 1975 19 communes exceeded the targets of the "Double Program"; 22 production brigades exceeded a "ton of grain," and 60 production teams exceeded the "Triple Program." Grain output for the region in 1975 totaled more than 8.8 billion jin, three times what it had been in the period immediately following Liberation. In recent years, between 3 billion and 3.3 billion jin of commodity grain has been annually provided the state in a commodity rate that is about 35 percent and accounts for almost one-half the province's total amount of commodity grain. This is the most important commodity grain base in the province. In this region the growing of rape is fairly widespread, the area of its cultivation being particularly large in Wujiang, Kunshan, and Wu counties, which are major producing areas in the province. About 50 percent of the province's output of rapeseed derives from this region.

Economic diversification is fairly well developed here. It is a major producing area in the province for slaughter hogs, the freshwater fishing industry, silkworm mulberry, and evergreen fruit [trees]. Live hogs number one-fourth the total in the entire province; more than 30 percent of the province's output of freshwater fish comes from this region; and output of silkworm mulberry is more than 50 percent the province total.

Within the region, water conservancy and soil conditions differ for different types of soils. Formerly the farming system was largely a double cropping system of rice and wheat; however, the proportion of geng and xian paddy rice varieties grown and the proportion of intermediate and late rice grown differed. In the Meng He high flat field region, a certain proportion of rice, wheat, and beans are grown in a system of three crops every 2 years, and in the Yangcheng lowland field area there are some single crop waterlogged fields. With development of the restructuring of the farming system in recent years, differences in these regions have been virtually eradicated. Only in the proportions of double and triple cropping systems, and in selection of varieties do slight differences still exist. The extent of economic diversification and distribution of diversified crops differ fairly greatly within the region. Evergreen fruits, in particular, are concentrated in hilly regions around the lake.

In future, development of agricultural production in this region will require continued major efforts in high standard farmland construction for consistently high yields. From a foundation of grown of the triple cropping system, vigorous attack will have to be launched to produce greater yields per unit of area to win high yields in every season and sustained increases in yields, and full use will have to be made of workforces and natural resources for further development of diversification. Principal emphasis should go to the growing of rice, wheat, and rape, and increasing output of live hogs, fish, and silkworm mulberry to build this region into one of ever higher output and a fully developed production base that provides more commodity grain and agricultural byproducts.

Second Section. Continued Major Efforts in High Standard Water Conservancy Construction for Permanent Control of Flooding, Waterlogging, Drought, and Water Stagnation

Following Liberation, under the guidance of Mao Zedong Thought, the broad masses of cadres and people of this region carried forward the revolutionary spirit of self-reliance and arduous struggle and relied on concentrated economic forces for major efforts in building water conservancy, moving an accumulated volume of about 1.5 billion cubic meters of earth and stone. They dredged main waterways into rivers and lakes to enhance water diversion and drainage capabilities. In lowland areas they joined dikes, installed gates at openings in dikes, and did construction inside the dikes. They devoted much effort to the building of small scale farmland water conservancy, did much leveling of fields, and laying out of fields in grids. They actively developed electromechanical drainage and irrigation facilities, more than 95 percent of the cultivated land being served by electromechanical drainage and irrigation, power equipment totaling about 500,000 horsepower.

Statistics for 1974 show construction completed on 4.86 million mu of farmlands in the region for assured harvests despite drought or flood, and for consistently high yields over 47.5 percent of the total cultivated area. In areas of a different type, a collection of high standard farmland construction models appeared providing rather well-rounded experiences. For example, in the lowland field area was Qianzhou Commune in Wuxi County and Chengbei Commune in Kunshan County. In the level field area was Meicun Commune in Wuxi County and Dayi Commune in Changshu County; in the hilly region was Huaxi Production Brigade in Jiangyin County and Yaoshang Production Brigade in Wu County.

By way of accelerating development of socialist agriculture to win higher and higher yields, all jurisdictions are now in process of building "ton grainfields." Using "ton grain field" standards developed out of survey and summarization of the experiences of a group of "ton grain" production brigades by the Suzhou Prefecture Water Conservancy Bureau, the following requirements are to be met in capital construction of farmland water conservancy: ability to ward off, ability to drain quickly, ability to lower, ability to irrigate well, garden style cultivation, and complete equipment. (1) Ability to ward off. On the basis of the all-time high water level, dikes is the Lake Tai Region must be higher than 1 to 1.5 meters. In case of a situation in which the water reaches its all-time high, all embankments and control structures must be able to keep out the water with no accidents taking place to assure a bumper harvest. (2) Quick drainage. All main waterways exiting rivers and entering the lake must be capable of being drained quickly, discharging water without a hitch. Within dikes must be continued advance lowering of water levels to increase capacity for eliminating waterlogging. Even when rainfall is at a rate of 300 millimeters per day, it should be possible to drain it away within 2 days without waterlogging. (3) Ability to lower. Ability to lower groundwater table so that when the rains stop the fields will clear, being able to regulate it at will, controlling the water table at a depth of from 1 to 1.5 meters below the surface of the fields. (4) Ability to irrigate well. Ability to irrigate from assured water sources during long periods without rain, ditches and channels forming an integrated whole with all around promotion of underground spodosol ditches for quick irrigation and quick drainage, using frequent irrigation to a shallow depth and scientific use of water. (5) Garden style cultivation. Making the soil level so that a little bit of water reaches every plant. Laying out of fields in a grid with plots of from 2 to 3 mu that are between 80 to 100 meters long and 15 to 20 meters wide. Separation of drainage and irrigation facilities, separate irrigation and drainage of hills, the water entering at one place and coming out another with separate entrances and exits and no interrelationship. (6) Complete equipment. All embankments, stream networks, ditch and channel irrigation and drainage power and structures are to be fully equipped and complete to derive fullest benefits from them.

In the building of "ton of grain fields" everywhere in this region, numerous problems requiring solution still exist in water conservancy construction that should be tackled from the following several standpoints.

1. Solution to an Outlet for Lake Tai Flood Waters

Solution to the problem of an outlet for flood waters from Lake Tai has yet to be found. In the area to the east of the lake, where dredging has been going on since 1954 in the upper reaches of the Dongtiao Xi to change its course, the volume of water entering the lake has increased. In addition, the linking together of diked areas and reclamation of lake marshes have diminished the water surface area and flood water storage capacity has been decreased. Furthermore, Taipu He has not yet been opened up for the discharge of flood waters; Wangyu He has not yet been brought up to standard, and the quantity of water discharged into the Chang Jiang has not increased. If a rainfall situation such as the one in 1954 were to occur, the volume of water entering the lake would increase to about 2 billion cubic meters, and on the basis of actual measurements taken in 1954, the water level at the mouth of the Guajin River would rise from 4.62 meters to more than 5 meters. These flood waters would be forced into the area of Yangcheng and Dianmao first where they would create a calamity. The 600,000 mu of scattered small dike lowland areas, and the 800,000 mu of semi-high fields to the east of the lake, in particular, are presently unable to withstand flood waters. To the west of the lake, water is drained mostly into Lake Tai and diverted into the region largely from the Chang Jiang. However, because of the complex terrain and the chaotic nature of the existing water system, flood waters from the northwest head southward, and flood waters from the south frequently turn northward toward Tao Lake, and turn back into the Nan He to enter Lake Tai again on a journey of more than 200 kilometers. Furthermore, the waterways meander and are very much obstructed. Two different flood waters follow a zigzag course, collecting together and flowing hither and thither, to "engorge" the lowland areas with water, frequently causing flood and waterlogging disasters. When the water level of the Chang Jiang and of Lake Tai rise at the same time, the situation is even more serious.

In order to solve the problem of an outlet for flood waters from Lake Tai, the principle that must be followed is to deal with floods and waterlogging separately, control the high and the low separately, plan for both storage and discharge, and disperse flood water discharge. Tai Lake's flood waters empty mostly into the Huangpu He in the east and secondarily into the Chang Jiang in the north. Floodwaters from the Hangjia Lake region must be drained largely southward into Hangzhou Bay. In order to do this, it is necessary to open Taipu He and to bring the Wangyu He up to standards permitting it to help discharge floodwaters. It is necessary, at the same time, to build a control line on Lake Tai to make the most of Lake Tai's capabilities for regulation and storage, thereby rather thoroughly solving floodwater pressure on the Yangcheng and Dianmao areas. In the area to the west of the lake, control must be established in separate sections high water being drained from heights, water pumping stations being built along the Chang Jiang, and commensurate dredging of waterways for drainage and such engineering measures taken. High sections of the terrain should be used for the building of control locks on the Tongji He, the Xiangcao He, the Jiandu He, the Danjinzao He, the Biandan He, the Grand Canal, and the Wuyi He to form a control line for discharging high water from the heights, and adopt the method of controlling water at separate peaks, discharging flood waters in high sections of the terrain

through Jianbi to the Jiuqu river, the Xiao He, and Desheng He. This will make full use of a capacity of existing waterways to transport water and will, to the maximum extent possible, use gravity drainage at low tide. It is necessary, in addition, to build water pumping stations along the Chang Jiang so that when gravity drainage is not possible during high tide, flood waters can be pump drained into the Chang Jiang. In addition, in order to meet this regions requirements for both drainage of flood waters and diversion of water, it is necessary to dredge or open up some new main waterways.

2. Increased Irrigation Water Sources

The area to the west of Lake Tai currently requires an additional 3 billion cubic meters of water diversion or storage. During the July and August summer drought of 1971, the low water mark at Jianbi on the Chang Jiang was only around 3 meters, and during lowest tide, each of the locks along the Chang Jiang diverted less than 5 million cubic meters of waters per day, or an average of less than 1 cubic meter of water per mu of paddyfields. To the west of Lake Tai lie 700,000 mu of high plains where water sources are inadequate in dry years. For the 500,000 mu of Zao He high fields, for 150,000 mu of hills and downlands, and for some of the semi-high fields to the east of Lake Tai, standards for combating drought are not high.

Taking into account terrain characteristics of high in the west and low in the east, between Lake Tai and Ge Lake locks will be built in the future to form a Tai-Ge irrigation control line, and water level of the Tao and Ge lakes will be controlled to assure irrigation needs. In dry years, all the water pumping stations along the Chang Jiang will be used for both drainage and irrigation to augment water sources, and the Jianbi Electric Power Plant will be used to cool water, thereby diverting river water to augment water volume and satisfy farmland needs within the control line. Proceeding from a foundation in using drainage waterways, the northern section of the Wuyi Canal and the Xinyuedu He will be widened and other main watercourses will be dredged in order to satisfy needs to transport water for irrigation. In the area to the east of the irrigation control line west of Lake Tai, Lake Tai will be used as a water source, as will diversion of water from Xingou to the mouth of the Jiangyin Gang, and the raising of water for irrigation.

3. Major Efforts to Eliminate Waterlogging Damage

In this region waterlogging damage is fairly common. It greatly impairs consistently high yields from wheat, barley, and naked barley. Four separate rises and falls have taken place during the past 10 years in output of wheat, barley, and naked barley. Reasons for waterlogging damage are mostly as follows. Much rain falls during the growing season for wheat, barley, and naked barley. Total rainfall during the growing season is more than 500 millimeters, most of which is concentrated during the time of sowing, jointing, and ripening stages of wheat, barley, and naked barley. During the time when wheat, barley, and naked barley are sown, in years when warm, moist air currents are active, very rainy weather often occurs. During early and mid November volume of rainfall is between 50 and 70 millimeters, or more than 100 millimeters in a maximum years. Rainy days number between 7 and 10, the

maximum number of rainy days being more than 10. As a result, the fields become sodden and the seeds rot, causing wetness damage during the sprouting season. During the past 25 years (1951-1975), this has happened in 8 or 9 years for an average of once every 3 years. In springtime the jointing to ripening stage for wheat, barley, and naked barley occurs just when cold and warm air currents from the north and south intermingle most, bringing numerous consecutive days of rainy weather. Each period lasts a long time, the longest being somewhat more than 10 days. During the past 25 years, average total precipitation during the final stages of growth of wheat, barley, and naked barley (March to May) has been from 270 - 320 millimeters, rainy days numbering from 34 to 42 for an average of 1 rainy day every 2 to 2.5 days. In years of heavy rain, volume is more than 400 millimeters, rainy days numbering about 50. Varying degrees of wetness damage occurred in 10 to 19 years, some places averaging occurrences once every 2 to 2.5 years. In some other places it was two occurrences every 3 years. Much rain in the spring season is the main cause of wetness damage to wheat, barley, and naked barley in the Lake Tai Region. (2) High water level in the waterway network. In some lowland fields and flat fields, control standards are inadequate, and water level in the water network is still fairly high. In some low-lying diked areas, in particular, when a fair amount of rain falls in spring, the water level in surrounding streams comes almost to the top of the land, and water level in streams within the dikes is within 1 meter of the top of the stream bed. In low, flat field areas, the water level in streams is often less than 1 meter below the top of the stream bed. Under such circumstances drainage to lower the water table is very difficult. (3) Soils are heavy; porosity is poor; and water retention capabilities are strong. The porosity coefficient is generally only about 0.5 meters per day, insufficient to eliminate retained water from the top layer of the soil and ground water. (4) Overly high groundwater table. In some farmlands where water conservancy facilities are rather poor, because water level is high in the water network, soil porosity is poor, and the field channel and ditch system lacks coherence, the water table in wheat, barley, and naked barley fields rises easily but does not fall easily. During the rainy spring season, the water lies only 50 or 60 centimeters or less below the surface in these fields, causing an excessively wet soil environment that impairs growth and development of the root systems of wheat, barley, and naked barley.

To summarize existing experiences in the drainage of water to prevent waterlogging, it is necessary, first of all, to control water level within the waterway network. Linking of dikes, separation of waters inside and outside the dikes, and control of water level in waterways constitute the foundation for control of waterlogging in diked areas. In flat field regions, attention must also be given control of water levels in ditches and ponds. Control standards for water levels in streams should be set at greater than the depth of the water table that is correct during all stages of growth of wheat, barley and naked barley. This is at least 0.2 meters lower, the actual action taken to be detrmined by the weather and soil moisture content. In some low flat field areas where water level in streams does not meet control standards in height from the surface, gates to control water level should be fitted to dike openings in selected dikes. Stagnant ditches and ponds should be filled in when leveling the land, or be used for the discharge of water to regulate

water levels. Secondly, it is necessary to improve drainage of water from fields. Facilities for drainage of water from fields should include deep covered ditches plus opening of shallow open ditches. Types of covered ditches include tile pipe, spodosol pipe, rat burrows, [7857 6670], and tufa [0960 1012] covered ditches. General methods may be adapted to local situations for continued improvements. Depths and distance apart should be set mostly on the basis of soil porosity in fields. In general, in clay soil fields, ditches should be 1.2 meters deep and less than 10 meters apart. In loam fields, they should be 1.2 meters deep and about 15 meters apart. In sandy soil fields, ditches should be 1.0 meters deep and more than 20 meters apart. For open ditches, a depth of about 0.4 meters that breaks the plow pan is about right, the form of layout being principally along the long axis of the field, one or two of them between two covered ditches, with two or three of them running horizontally on field plots. With contour ditching, general methods may be adapted to local situations to enlarge the spread of experiments to substitute for increased digging of shallow open ditches. No matter whether for covered or uncovered ditches, in flatland fields or in lowland areas, waterways have to be part of a coherent whole. In hilly areas, main drainage ditches have to be dug to assure that drainage waters have an outlet. It is also necessary to build channel-side ditches and water separation ditches to catch water that leaks from discharge channels and adjacent waters. Third, drainage facilities must be well managed. Every ditch should be linked to every other one so waters pass quickly, and so that after rains stop the fields are clear of accumulated water. When water is drained through covered ditches, it is also necessary to have manholes, the manholes being cared for. Fourth, planting should be done in continuous tracts to prevent a situation of alternating floods and drought causing man-made waterlogging damage.

4. Restructuring of the Old Waterway Network and Doing a Good Job of Leveling the Land and Field Projects

The existing old waterway network is generally deficient in being crooked, chaotic, shallow, narrow, and interrupted. It is not good for diversion, drainage, lowering of water levels, storage, or travel. Some of the farmland field projects and structures are not fully equipped; conflicts result in their use for floods and drought; drainage and irrigation quality is poor; and in some of them a situation of furrow irrigation and flood irrigation still exists. A lot of land leveling projects are still necessary, and they will require a lot of work.

Restructuring of the old waterway network and the building of a new water system will require all around planning and assignment of responsibility at every level to make a water system in which all individual components in the network function properly. Building of a waterway network requires building of a six part water system. The Lake Tai basinwide master waterway for the discharge of flood waters and drainage of waterlogging is the first part of the system. The inter-county areawide main drainage waterways into rivers and the lake is the second part. The third part of the system is the major regulating waterways that link the part one and part two waterways, or the diversion and drainage waterways within the province that are linked to rivers. The major water diversion, drainage, and shipping waterways linking communes to the county or communes to each other are the fourth part. The main

waterways linking production brigades in a commune and the main waterways within a dike are the fifth part of the system. The branch waterways of the fifth part of the system constitute the sixth part of the system. The layout and pattern of the waterways is as follows: Depending on water diversion, drainage, and regulating needs in combination with development of plans for shipping arteries, the first, second, third, and fourth part of the waterway system will mostly use the old water system after it has been dredged, the curves straightened, and deepened rather than broadened to reduce the area wasted through excavation. Unified planning for the fifth and sixth parts of the waterway system should be done on the basis of requirements for irrigation, drainage, lowering water levels, and shipping, as well as for the accumulation of shipment of fertilizer, the growing of "three water crops," [hollow stem water cabbage, water hyacinths and water lettuce], raising of fish, the people's needs for water in their daily lives, and water needs for industries operated by production brigades. This planning is to be done in combination with the leveling of fields, the opening of new watercourses and the filling in of old watercourses, principally with restructuring in mind, so as not to harm cultivated land.

Energetic leveling of field plots and the laying out of fields in a grid system should be done everywhere. Field projects should emphasize separation of irrigation and drainage systems, rapid irrigation and rapid drainage, and effective control of groundwater tables, all these things being part of a coherent whole. This is to say waters inside dikes are to be separate from waters outside dikes, waters at higher elevations separate from waters at low elevations, drainage separate from irrigation, and wetlands separate from drylands; control of water levels within the system, and control of water tables; full equipping with electromechanical power, integration of ditches and channels for irrigation, drainage, and lowering of water levels, and full equipping of structures. In bringing the Zao He high fields under control, a series of locks can be built along the Zao He for section by section control that would restructure the old Zao He with the building of an upriver network in a two part network upriver and downriver, and installation of stations to provide additional water to augment irrigation sources. In small areas where topography is complex, the upriver section may be linked directly to the downriver section to make a first category water level. In downlands and hilly regions, storage, diversion, lifting, drainage, and lowering of water must all be given emphasis in an all around coherent system employing ponds, reservoirs, ditches, channels, roads, forests, and buildings. There has to be major efforts made to create fields along hill slopes to improve the prevention of soil erosion, with simultaneous gradual development of spray irrigation.

Third Section. Development of Diversified Triple Cropping System For High Yields in All Seasons and Constant Increases in Yields

In recent years, the Lake Tai Region has restructured its farming system from the longstanding double cropping system of rice and wheat to the wide area growing of three crops each year. At the present time, a paddyfield area growing two crops of rice in a triple cropping system has been developed over more than 95 percent of the flat field area of Wuxi and Wu counties, over about 70 percent of the marshy fields of Dianmao and the lowland fields of

Yangcheng, and over about 50 percent of the Meng He high plat fields, the flat fields of Tao and Ge, and the low field area south of Tao lake. Experiences have shown that active creation of conditions, restructuring of the farming system, and increasing the multiple cropping index are effective ways to realize increased grain yields. By 1973 all of Wu County had spread a triple cropping system containing double crops of rice virtually everywhere, grain yields in 1974 then attaining 1,440 jin per mu in large area cultivation for a 34 percent increase over 1969 prior to restructuring of the farming system. In 1969, the first advanced unit in the province to successfully experiment with and give all around promotion to the growing of double crops of rice in a triple cropping system, Qiaolong Brigade, Changqiao Commune, in Wu County, carried out a comprehensive reform of its farming system. Next it bent efforts for an attack on improvement in yields per unit of area, and steadily improved the level of its scientific farming. Beginning in 1970, grain yields continuously exceeded 1 ton per mu, and in 1974 they overfulfilled national targets for the "three programs." Their experiences played a very great role in promoting reform of the farming system in the Lake Tai Region.

Henceforth, this region will further study improvements in the farming system for the development of diversified forms of a triple cropping system. At the same time it should energetically work on increasing yields per unit of area, giving full attention to a combination of nurture and use of the soil for high yields in every season and for continuous increases in output.

1. Equitable Planning of Crop Sequences and Crop Patterns for High Yields in Every Season

Development of a triple cropping system with double crops of rice and conversion of a system of two crops each year to three crops each year means an attenuation of the total growing season, and tight scheduling of tasks in each season. It requires growing in 365 days of the year three different crops collectively requiring more than 450 days of growth. During the somewhat more than 220 day frost free period, it is necessary to arrange for two crops of rice requiring a total growth period of from 240 to 250 days. The crop growing season is long, and conflicts in tight scheduling of the farming season are extremely pronounced. It is necessary to operate on the principle of "three advantages," adapting general methods to local situations in planning the sequencing of crops and crop patterns of various varieties. This requires what is advantageous for three crops in 1 year for high yields from each crop, and guarding against emphasis on rice while slighting wheat or emphasis on the early crop while slighting the late crop. Second it requires doing what is advantageous to "taking grain as the key link, overall development, adaptation of general methods to local situations, and proper centralization," guarding against a single crop economy and squeezing out economic diversification. Third it requires whatever is advantageous for a combination of use and nurture of the soil, preventing concern only for increased yields in the present year without concern for nurture of soil fertility. In summarizing the practical experiences of this regin regarding crop patterns in a triple cropping system in which early ripening summer crops predominate, paddy rice growing requires equitable matching of early, intermediate, and late varieties. Only when summer ripening crops ripen early is it possible to steal a march and get hold

of the initiative for all seasons in the year. Only through matching early, intermediate, and late ripening varieties in both the early and late crop to form a coherent whole can the potential for increased yields from late ripening varieties be fully realized, can farm work be staggered, planting and harvesting be done at different times, and workforces be properly allocated to seize the initiative over seasons. To do this requires "one maintenance and three changes." By one maintenance is meant maintaining the growing of green manure over about 25 percent of the total cultivated area to provide seedling fields, an early crop, and fertilizer for the first rice crop. By the three changes is meant a change of some of the late ripening wheat to barley, naked barley, and early ripening wheat, increasing the growing of barley and naked barley from 20 percent of the field area to 60 percent to provide room in the cropping sequence for the first rice crop, and to leave room in the cropping sequence for later growing of rape, early wheat, and green manure. Second is a change in the single use of late ripening varieties or early ripening varieties in both the first and second rice crops. This permits equitable matching of various varieties of rice with different ripening times, the early ripening varieties matched for each season providing early cropping for the following season, thereby achieving in the rush harvesting and rush planting season no slackness during the first crop, no voids in the intermediate crop, and no urgency in the final crop. Third is a change of low yield varieties for high yield superior varieties. Existing superior rice varieties for the first crop are mostly Erjiuqing, Yuanfengzao, and Guangluai No 4. For the second crop, the main rice varieties are Nonghu No 6, Shuangfeng No 1, Guihuahuang, Nangeng 33, Sugeng No 4, and Gehou No 2. It is necessary, in addition, to purify and rejuvenate seeds and to constantly breed successor varieties.

In order to improve rice, wheat, barley and naked barley yields per unit of area in every season, this region also did a lot of work in two stage propagation of seedlings and gradually expanded the area of late ripening varieties. This was an effective measure for avoiding an overconcentration of workforces for further surmounting of difficult seasonal problems. In 1975 the region promoted the growing of two stage rice seedlings for the second crop of rice for a more than 2 million mu area. It grew small seedlings in seedling fields, strengthening them through growth in temporary beds prior to planting in fields, trading space in the temporary beds for time in the open fields, thereby both making the conflict between growing seasons less intense and saving on the seedling field area to improve seedling quality and to assure consistently high yields from the late cropped second crop of rice. Some places also used two stage seedling propagation for the first rice crop so that they could get high yields from greater use of late ripening varieties. They also expanded use of plastic sheeting in the propagation of seedlings for the first rice crop, enabling some areas to advance the date for sowing of their crops of green manure - rice - rice to gain time and help obtain high yields. However, two stage propagation of seedlings requires a lot of work and labor intensivity is great. To solve the problem of conflicts in growing seasons, it will be necessary in future to study ways in which to improve crop patterns for different varieties.

Today outputs from the late rice crop are neither high nor consistent. Frequently failure of the heads to droop [resulting in poor germination] occurs in years when temperatures are low. In years when temperatures are high, panicles are small, and sometimes some varieties do not droop heads while others produce small panicles all in a single year. Therefore prevention of erect heads and small panicles in the late crop is yet another key means of consolidating and tapping potential for increased yields from the triple cropping system. Results of scientific experiments and practice in production both show that low temperatures during the period when the late rice crop is forming panicles and flowering are a direct cause of erect heads (numerous empty glumes and failure of panicles to droops). Overly early sowing, failure to transplant on time, and an overly long seedling age may result in small panicles. If full heading occurs before the advant of low temperatures in the fall, i.e. if full heading occurs during the safe period for full heading, high and consistent yields are virtually assured from the second rice crop. Cold tolerance differs strikingly among various varieties of late crop rice, and safe heading period indices also vary. For geng rice varieties least tolerant of cold such as Erjiuqing and Ainanzao No 1, the safe heading index is average daily temperatures stabilized at about 22°C and temperatures that do not average lower than 22°C for 4 consecutive days. Geng rice varieties fairly tolerant of cold such as Nonggui 69, Jiangfeng No 3, Yuhong No 3, Tudao No 3, Wunuo No 1, and Guihuano, the safe heading index is average daily temperatures about 20°C and no temperatures averaging below 20°C for 3 consecutive days. Fairly strongly cold tolerant geng rices such as Nangeng 33, Wunongzao, Huxuan 19, and Shuangjiangdao have a safe heading index of average daily temperatures stabilized above 20°C with no average temperature of below 20°C for 4 days in a row. Strongly cold tolerant geng rice such as Nonghu No 6, and Nongken 58 have a safe heading index of average daily temperature stabilized above 20°C with no weather where temperatures are lower than 19°C for 4 consecutive days. All areas have to do rational planning of crop patterns on the basis of atmospheric temperature data over the years and meteorological conditions in the current year. To prevent small panicles, it is necessary to sow seeds at the right time for particular varieties and to transplant seedlings at the right seedling age.

In order to reduce the amount of late cropping, it is essential that cutbacks be made in the growing of wheat in favor of increased growing of barley and naked barley. However, commodity value of barley and naked barley is poor, and the masses are not accustomed to eating them. Energetic efforts should therefore be made to breed specially early ripening wheat varieties that will ripen before 25 May to replace some of the barley and naked barley.

The experience of several years has shown that development of a triple cropping farming system with twin crops of rice is a major means by which this region can increase grain output; yet it also gives rise to numerous conflicts. These conflicts are increasingly coming to notice and gradually being recognized by the people. One of them is the great pressure on the growing seasons and on workforces. To grow three crops in a single year means tight scheduling of individual crop seasons. If sowing and transplanting of rice, wheat, barley and naked barley is not done at the right time each year over a substantial area, high yields from that large area will be impaired.

Furthermore, unless there is some room for maneuver, it will be difficult to avoid calamitous weather and impossible to assure consistent output. The amount of labor expended is great and pressure on the workforce is extremely great. Work is extraordinarily arduous. Secondly, the system is not a good one for nurture of the land, and in some places the physical properties of the soil show a tendency to become bad. Thirdly, farm costs increase, and for some communes and brigades, output increases with no commensurate increase in earnings or increased output may even bring decreased earnings. The grain commodity situation is poor and the consumption rate declines. Fourth, all around mechanization is difficult when such a system of farming is practiced. Consequently this region's farming system requires further study and exploration for improvement. The proportion of land devoted to a triple cropping system with double crops of rice should not be decided with "arbitrary uniformity." It should be decided in terms of production situations in individual areas.

This region began experimental plantings of hybrid rice in 1976. Used as a single rice crop, yields everywhere reached about 1,000 jin per mu, high yield fields producing more than 1,300 jin. Used as a second crop in a double rice crop system with a green manure crop in between crops, yields reached about 800 jin per mu. In future, expanded experimental planting and promotion can be done, hybrids being used to replace rice grown as a single crop remaining in some places. In places where a triple cropping system with double crops of rice predominates, or where a triple cropping system with double crops of rice is 100 percent, the pressure is great during the last of the three crop seasons. If both the early and the late rice crops are transplanted a little late, yields will be neither high nor consistent, and outputs from a single crop of hybrid rice will generally be as great as or better than outputs from the late crop in a double rice crop system. Therefore, consideration should be given to changing the growing of rice as a late crop in a triple cropping system to a double cropping system of wheat and hybrid rice. In between the two crops duckweed may be grown, or a summer green manure may be transplanted. Such a method not only does not impair output, but help keep initiative in the overall situation. A system of barley or naked barley - early soybeans - hybrid rice, or of barley or naked barley - early corn - hybrid rice for the growing of two dryland and one wetland crops should also be actively experimented with and, if successful, be used on a certain proportion of the cultivated area. It is necessary at the same time to actively breed hybrid rice varieties with a short growing period for use as a late rice crop to make high yields even higher. In short, experiments should be conducted using diverse forms of a triple cropping system, and their promotion through adaptation of general methods to local situations.

2. Mastery of the Laws of High Yields From a Triple Cropping System with Double Rice Crops to Increase Rice, Wheat, Barley, and Naked Barley Yields Per Unit of Area

Following changes in the farming system, very great changes took place in the laws regulating the harvest and planting seasons, farming methods, and the incidence of diseases and insect pests in rice, wheat, barley, and naked barley varieties. For several years the broad masses have steadily explored

the laws governing high yields in a triple cropping system with double crops of rice. They have summarized the rather fullsome experiences and have promoted these experiences, which have played a very great role in increasing rice, wheat, barley, and naked barley yields per unit of area.

In order to get high yields from double crops of rice, it is necessary to master the following: (1) Lay a foundation for the propagation of sufficient numbers of sturdy seedlings at the right age. The period during which seedlings are in seedling beds in a triple cropping system with double crops of rice is about one-third the total growing period. If great temperature changes occur during the seedling propagation stage, numerous grains in their husks will fall off later. Seedling age requirements are strict, and techniques are very important. Technical skill must center on "maintenance of areas, doing things in their proper season, assuring proper closeness in planting, getting large panicles and winning high yields," combating disasters to propagate sturdy seedlings. In order to prevent seedling rot in the first rice crop, and rotting of seeds in the second rice crop, "ventilated seedling beds" must be used for the propagation of seedlings. In order to improve rice seedling quality, different amounts of seed should be sown depending on the preceding crop grown on the soil and the variety of rice grown. It is necessary to stick to sparse sowing, adequate fertilizer, and intensive care to nurture sturdy seedlings. In the propagation of seedlings plastic sheeting and growing of seedlings in open fields may both be done for the early rice crop. For the late crop, single stage and two stage propagation may be matched with each other to lay a fine foundation for high yields from both rice crops. (2) Shallow transplanting of closely spaced plants produces numerous panicles. The open field growing season for paddy rice in a triple cropping system of double rice crops is short. In growing it, one must keep his eye on both "reliance on transplanting," and on "making plants grow." This means transplanting a sufficient number of basic seedlings, and planting them shallow for early growth. For both early and late rice crops, about 45,000 to 50,000 plantings per mu should be made. The later planting is done in the season and the closer the transplants, the higher the quality to achieve the goal of numerous panicles. (3) Early care and intensive care to promote early development. For double crops of rice in a triple cropping system, the growing season is short and the time of panicle differentiation comes early. Care is also strongly seasonal, and when harvesting, planting, and care for the early, intermediate, and late crops all come at the same time, one very easily might take care of one thing and let others slide, resulting in early planting with no early development with resulting "seedling stubbornness" and unwillingness to develop. Consequently, one must center attention on requirements for "early development of the early crop to get numerous panicles, steady growth in mid-season for large panicles, and keeping plants alive through ripening for numerous grains." One must begin care early, give complete care, and give intensive care, giving care even before planting is finished, and giving care as soon as planting is done. In addition, one must dig deep ditches in ricefields for timely drainage of the fields, striving for early development in all seasons and early control to win early ripening. (4) Prevention and control of diseases and insect pests to assure bumper harvests. Following changes in the farming system, kinds of diseases and

insect pests were numerous, quantities large, time of occurrence early, and period of infestation long necessitating intensification of prevention and control of disease and insect pests. Particularly requiring attention were new outbreaks of thrips, leafhoppers, sheath and culm blight, and neck blast.

Formerly the Lake Tai Region generally regarded wheat, barley and naked barley as "minor crops" whose output was neither high nor consistent. As a result of serious attention to the culture and care of wheat, barley, and naked barley in recent years, outputs have gradually risen, and some advanced production brigades have broken the targets of the "National Program" for the growing of a single crop of wheat, barley, or naked barley, thereby demonstrating the very great potential for increased yields from wheat, barley, and naked barley. If consistently high yields are to be obtained from wheat, barley, and naked barley, levels of growing and care will have to be improved further. It will be particularly necessary to surmount the effects on high yields of growing as a late crop and the damage wetness causes to consistently yields, which are the two conspicuous contradictions in growing it. Experiences of advanced units such as Liu Brigade of Tangqiao Commune in Shazhou County show it is most important to master the following: (1) "Seeking earliness in the midst of lateness." Once a triple cropping system with double crops of rice has been developed, conflicts in growing seasons of wheat, barley, and naked barley are extremely pronounced. In order to be able to plant the late crop early, get late crop seedlings planted early, and get early development of late crop seedlings, in addition to making every second count in planting early, it is also imperative that attention be given to improved quality of fall sowing. It is necessary, at the same time, to guard against the cultivation of sodden fields and the rotting of seeds, to practice deep plowing in thin bites of the plow, breaking up of the soil throughout all soil layers, getting fertilizer down into all layers, careful leveling of the soil, sowing of seeds that have been prepared for accelerated sprouting, uniformly shallow sowing, covering of the seeds with marl, and then taking care of what has been planted for early sprouting and development of the late crop of wheat, barley, or naked barley. At the same time, depending on conditions, experimental promotion of some transplanting of wheat, barley, or naked barley may be tried so as not to have late planting of the late crop.
(2) Guarding against wetness damage. There should be a combination of covered and uncovered ditches and preparation of a set of ditches to eliminate surface water, reduction of water retention in the top layer of the soil, and reduction of the water table. Planting should be done in continuous tracts to prevent "wetlands enveloping drylands." (3) Skilled fertilization. Fertilization should be done with regard for the weather, for the condition of the soil, and for the condition of growing plants. Generally one must apply sufficient base fertilizer, fertilize early with seedling development fertilizer, heavily fertilize with winter fertilizers, skillfully fertilize with greening up fertilizer, make general applications of jointing and booting fertilizer. (4) Meticulous Care. Particular attention must be given winter care. Once seedlings have three leaves, a combination of winter fertilization, breaking up of small lumps of earth, and smoothing of the soil surface to protect the roots against cold and promote increased tillering of roots should be done. (5) Prevention and control of diseases and insect pests. Prevention and control of armyworms, aphids, and cereal scab, which are most destructive, is necessary.

3. Major Efforts to Increase Fertility and Improve Soil by a Combination of Soil Use and Nurture to Win Continuous Increases in Yields

A survey done by the Nanjing Soil Institute of the Chinese Academy of Sciences shows requirements for "ton of grain fields" in this region to be as follows: A fairly thick cultivated layer of from 18 to 20 centimeters, good porosity, a water immersion capacity of 0.5 to 0.6 grams per cubic centimeter, micro-clustering (diameter of 1 - 0.005 millimeters) of more than 30 percent, good plowability, soft but not sodden when wet plowed, and glutinous but not sticky, crumbly and small bits of soil when dry plowed, a plowplan layer with a thickness of about 8 centimeters that is slightly compact and that holds water and fertilizer, a small amounts of striping of the sub-soil layer with fairly well defined perpendicular jointing, clean but not leaking; no belozem layer, blue mud layer, or ferrimorphic yellow soil layers to cause obstructions; a fairly high organic content in the cultivated layer, generally 2.5 to 3.0 percent; a fairly high total nitrogen content of 0.15 to 0.2 percent; an 0.08 to 0.12 percent phosphate content, and more than 10 parts per million of quick acting phosphate; 1.5 to 2.0 percent total potash and 8 - 10 milligrams per 100 grams of soil of quick acting potash; a pH that is slightly acid to neutral.

According to 1974 representative survey results from all counties in the region on changes in soil fertility following restructuring of the farming system, generally speaking, as a result of steady improvement in water and fertilizer conditions, soil fertility continued at a fairly high level. For example, a survey of 10,754 mu of farmland in six production brigades in Badou and Hubin communes, and in five production teams in Pingwang commune in Wujiang County showed a rise in soil fertility in 13 percent of cases, no noticeable change in 70 percent of cases, and decline in only 8 percent of cases as compared with large areas prior to the restructuring of the farming system. Survey results from Tacang County pointed out that as a result of strenuous efforts in balanced increases in yields, soil fertility of two or three kinds of fields increased over what it had been, and declined in one former category of field as a result of improper cultivation and fertilization. In some places, following practice of a triple cropping system with double crops of rice, some new problems with soils in some field plots occurred as a result of long periods of immersion of ricefields; the pressure on successive growing seasons that did not permit dry plowing and sunning of the soil, the problem being intensified by the use of 12 horsepower hand tractors that did not plow sufficiently deep; slippage in fertilization, particularly the return to the fields of little rice straw; and improper crop rotation. These new problems were mostly: (1) the cultivated layer became shallow and blue mud emerged in it. Fields in which the cultivated layer is as deep as 18 centimeters number only 15 percent of the total today, most of them having a cultivated layer that is 10 to 12 centimeters. This is 4-6 centimeters shallower or even 7 to 8 meters shallower than formerly, and the crop nutrient area has much declined from what it had been. Because the cultivated layer has become shallow and the old cultivated layer has not been plowed for a long time, the plowplan layer has thickened in the upward direction. When drainage is bad and reducing action strong, a blue mud layer forms and, in most years, this blue layer becomes water saturated and virtually lacking in pores for ventilation, which is bad for crop growth.

(2) Soil porosity is poor and stiffness has developed. Appearance of the blue mud layer causes soil porosity to turn for the worse; soil water retention is strong, stiffness occurs, and wetness damage is severe. (3) Soil nutrients are released slowly and effectiveness of chemical fertilizer declines. The soil is drowned for a long period of time, so organic matter does not readily decompose. Its supply is not available for the early period. Effectiveness of nitrogenous fertilizer declines, increased paddy yields amount to only between 1 and 2 jin or even less than 1 jin per jin of ammonium sulfate. Nitrogen content of rice straw reaches around one percent, and the rate of empty or shrivelled glumes of paddy increases. Extent of phosphate deficient soil increases, and potash deficient soil also begins to appear.

In order to win continued increases in yields, major increases in fertilization and soil improvement are necessary, attention being given to a combination of soil nurture and soil use in the following main ways:

1. Increased use of organic fertilizer. Major efforts must be made to grow, collect, make, and increase sources of organic fertilizer. In addition to large scale raising of hogs, sheep and goats, and rabbits with increased collection of farmyard manure, special efforts must be made to grow a sufficient area of winter green manure, the "use of phosphate to increase nitrogen," "exchange of small amounts of fertilizer for large amounts of fertilizer," and innoculation of root nodule bacteria, plus intensification of care, and increased output of fresh grass. Full use must be made of unused land in the four besides and of intercropping in rice paddies during the previous season of summer green manure crops such as sesbania. Duckweed must be grown in the right season as well. Return of rice straw to the fields plays a major role in improving the physical structure of the soil. Great efforts must be made to promote the use of methane gas in rural villages to save on the burning of straw so as to increase the quantity of rice straw returned to the field. Grass-mud rotted manure is a traditional way in which this region has accumulated organic fertilizer. This requires an extremely large amount of work, and its gathering, making, hauling, and application to the fields cannot be readily mechanized. Moreover quality of river mud has also declined, and its nutrient content is virtually identical with that of the surface soil of open fields. Consequently, these methods of collecting and making organic fertilizer must be studied and reformed. Attention may be given to: Maximum use of green manure as a feed for hogs; composting of a portion of stalks and stems of rice and wheat for return to the fields, another portion being chopped up to make coarse animal fodder or ground and used as bedding for livestock to increase the volume of banyard manure, organic fertilizer thereby becoming concentrated, highly effective, and amenable to mechanized hauling and application. There should be further compounding of mixed fertilizers done on the basis of soil nutrient conditions and containing nitrogenous, phosphate, and potash fertilizers with trace elements and used on appropriate soils to build a scientific system of fertilization.

2. Deepening of the cultivated soil layer. Urgently needed is improvement and selection for use of farm implements that do the job and are able to plow deeply to deepen the cultivated layer of soil. Through equitable planning of crop sequences, each year a certain portion of fields plots may be rotationally

dry plowed and sunned, or the plowed land frozen in order to improve the physical structure of the soil. General methods should be adopted to local situations to change scatter sowing of wheat, barley, and naked barley to sowing in rows, so that wheat fields may be cultivated between rows to loosen the soil. This also serves a definite purpose in improving the physical structure of the soil. In addition it is necessary to give attention to proper management of water in ricefields with digging of deep ditches and draining the fields on time to improve soil and soil ventilation.

3. Practice of Purposeful Crop Rotation. Summer ripening crops should be planted in a triple cropping system of grain, edible oil crops, and green manure, early, intermediate, and late varieties of rice being planted. Winter green manure area should be maintained at between 20 and 30 percent of cultivated land area so that within a period of from 3 to 5 years each field plot will be rotationally cropped to green manure once. In addition, experiments should be run on rotational cropping of some fields alternately as wetlands and drylands.

4. Improvement of low yield soils. In lowland field areas, low yield soils are principally shutou [6264 7333] black hill soil and blue mud soil. In flat field areas they are mostly belozem; and on the Meng He high plat field area is goutou [3699 7333] sandy soil. The cause of low yields from shutou black hill soil and blue mud soil is poor drainage, heaviness occurring with little wetness. Though organic content and nitrogen content are fairly high, the organic content does not readily break down, and mineral nutrient effectiveness is poor. Furthermore soil structure is poor, being stiff and sticky making cultivation difficult. Consequently, it is necessary, first of all, to begin with water conservancy measures, reducing river water level, draining away water from the fields and lowering groundwater to solve the problem of excessive soil wetness. At the same time it is necessary to increase the quality of cultivaton, doing a good job of draining water and drying fields during the growing season for rice. Belozem is relatively deficient in organic matter, nitrogen, and phosphate. It is sticky with small grains; its structure is poor; and it cakes and is stiff. It has to be properly crop rotated, its organic matter increased. Growing of green manure in combination with use of phosphate fertilizer "using phosphate to increase nitrogen" produces very remarkable results in improving shutou black hill soil and blue mud soil. In addition to being poor in nutrients and being granular and stiff, making for difficulties in cultivation, goutou sandy soil loses water and fertility. More organic fertilizer must be used on it, and soil must be brought in from elsewhere to increase the thickness of the cultivated layer.

Fourth Section. Development of Economic Diversification Mostly Through Live Hogs, Aquatic Products, and Silkworm Mulberry

1. Growing Aquatic Animal Feeds for Use and Energetic Development of Hog Raising

In the Lake Tai region the hog raising industry is fairly well developed; it is the area in which the famous lake hogs are produced. Since this is a major grainproducing area, a fairly abundant supply of fodder for the hog raising

industry is produced. At the same time, the greater the development of the hog raising industry, the greater the amount of organic fertilizer provided for agricultural production and the more agricultural development is advanced. Consequently, this area has historically had a fine combination of agriculture and livestock raising. With general promotion of a triple cropping system with double crops of rice, even greater development of hog raising has become necessary with increased accumulation of fine quality pig sty organic fertilizer. Looked at in terms of the experience of units producing high yields, in order to get annual grain yields of "a ton of grain" per mu, "one pig per mu" or "one pig per person" is necessary. Therefore, energetic development of hog production possesses major significance for both satisfaction of people's need for meat and for high output of fertilizer for agriculture.

Development in this region in recent years of aquatic feeds such as hollow stalk swamp cabbage, water hyacinths, and water lettuce has promoted development of hog raising. This region has a broad expanse of water surfaces on which potential for expanded growing of the "three water crops [hollow stalk swamp cabbage, water hyacinths and water lettuce]" is great. Yuexi Commune in Wu County has provided experiences in "three water crops to promote raising of three kinds of animals, and the raising of three kinds of animals to promote three crops for high yields from every crop. Beginning in 1970 that commune grew "the three water crops" over a wide area as fodder for raising hogs, sheep or goats, and rabbits. In 1975, the commune raise "the three water crops" on a 36,000 mu area and used 460,000 dan of fodder from them. Number of hogs raised during the year numbered 1.6 head per mu, and fairly great development of sheep or goat and rabbit production also occurred. Another 150,000 dan of "the three water crops" was directly composted to make fertilizer for the fields. When mostly "the three water crops" are used to raise hogs, a certain amount of concentrated feed must also be assured, and it is necessary to adapt general methods to local situations to make equitable plans for the use of some land to grow animal feed crops, as well as to make full use of empty places in the four besides to plant juicy animal fodder plants that produce high yields. Some Chinese milk vetch should also be used as hog feed to improve nutritional levels of animal feeds.

Improvement of hog breeds is a major way in which to improve hog quantity and quality and to promote the growing of hogs. Lake hogs are a traditional regional breed of this region; however, most are now mongrelized and their productivity has suffered. Purification and rejuvenation must be vigorously pursued for rapid building of superior breed herds of lake hog sows. Also necessary is active promotion of "our -izations," namely bringing of boars from outside for improvement of breeds, use of local sows for superior breeds, hybridization of one generation of slaughter hogs, use of artificial insemination in the breeding of hogs. Proper economic hybridization has remarkable effectiveness in increasing output.

2. Full Use of Water Surface Resources and Vigorous Development of a Freshwater Fishing Industry and Aquatic Plants

The Lake Tai region is crisscrossed with rivers; marshes abound, and fish ponds and ponds dot the landscape. The waterland area totals 6.25 million mu

or 24 percent of the province's total freshwater area and 28 percent of the region's total land area. Water surface resources abound and water levels are fairly stable, providing a vast base for freshwater catches, breeding and growing. A look at typography, hydrology, meteorology, and chemical properties of the waterlands shows most of it suitable for growth of fish and aquatic crops. Of the almost 5 million mu of lakes, 16 lakes are larger than 10,000 mu, and 128 are larger than 1,000 mu. The large and medium size lakes are suited for development of fishing, and medium size and small lakes are suitable for development of breeding of fish in surrounding marshals or man-made pools or for growing of plants. Rivers, drains and ditches cover 1 million mu and are suitable for use as streams for hatching of fish. Ponds cover 320,000 mu and are suitable for intensive fish breeding and semi-intensive fish breeding. In those in which the environment is poor, aquatic plants such as water chestnuts and lotus root may be grown. In addition to the several kinds of fish that can be bred to provide very great quantities, in most of the natural waterlands of this region, both kinds and quantities of fish resources available are extremely abundant. Investigation shows more than 71 kinds, more than 40 of which have economic value and 18 of which are those most frequently fished for. These include mei anchovy [2734 9662], dao anchovy [0435 9662], white bait, black carp, grass carp, silver carp, variegated carp, common carp, crucian carp, Chinese white fish, eels, and bream. Lake Tai has numerous white bait, mei anchovies, and Chinese white fish. In Tao and Ge lakes, mostly there are mei anchovies. Mostly it is common carp and crucian carp in Dianshan Lake and Yangcheng Lake. Close by streams in the northeast contain a large proportion of eels, mullet, and perch that return to spawn. Ricefield eels are found in the lowland ricefields area of Wujiang, Wu, and Kunshan counties. Freshwater shrimp are found in large quantities in the grassy shallows of the eastern part of Lake Tai, in Dianshan Lake and in Ge Lake. White shrimp [4101 5802] are produced mostly in lakes and streams where rivers empty into them. River crabs are plentiful in Dianshan Lake and Yangcheng Lake. In addition, more than 70 different kinds of creatures live in the bottoms of water bodies. They are widely distributed in large quantities, and are both a major source of food for fish that live in the bottoms of bodies of water and some can be caught for use as food by man. There are more than 60 varieties of vascular bundle plant resources in rivers, lakes, and submerged fields. The important ones for cultivation are water caltrop, lotus root, cishi [5412 1395], wild rice, arrowhead, water chestnuts, water fennel, cattails, and rushes as well as hollow stalk swamp cabbage, water hyacinths, and water lettuce.

Production conditions in the Lake Tai region are outstanding, and freshwater fishing, fish breeding, and growing of aquatic plants can be developed in an all around way. Because of the vastness of the water surface and the continuousness of it, specialized operations there are possible. Water sources are copious, and in most drougnt-free years, fish may be raised in ponds. The masses have abundant experience in production, and their level of technical skill is high, favoring intensive operations. Of the almost 2 million mu of water surface now being used for hatching, somewhat more than 1 million mu is presently being used. Growing of aquatic products in ponds is fairly well established in Wu, Jiangyin, Wuxi, Wujin, Jintan, and Danyang counties. Raising of fish in streams is mostly concentrated in Kunshan, Changshu, Wujin,

Jintan, and Wu counties. Raising of fish in lake marshes is fairly well developed in Wujiang, Changshu, and Jintan counties. Freshwater fishing is concentrated in lake Tai, Yangcheng Lake, Ge Lake, and Dianshan Lake. All counties grow aquatic plants.

This region has seen growth in aquatic products output in recent years; nevertheless, water surfaces are not yet completely used; the rate of increase in output is not great; and production is not sufficiently consistent. Yields per unit of area from fishing large areas of streams are not high, usually between 20 and 30 jin per mu and in some places only 10 jin. Fish breeding yields are also very uneven. In some advanced units such as Heluo Commune in Wuxi City where scientific fish raising is practiced, pond yields have been more than 1,000 jin per mu for 10 consecutive years, and have been 2,434 jin per mu from high yield experimental ponds. At Likou Commune in Wu County, a fishing brigade has harvested 1,600 jin per mu of mature fish from 22 mu of choice fish raising ponds. From the growing in 11 mu of choice fishponds of fish and mussels, the Yangguang Brigade of Luoyang Commune, Wujin County had yields of 1,100 jin per mu of mature fish and 7.4 jin of mussels. However, in many areas production is done carelessly, and yields are only 30 to 50 jin per mu. In short, potential for aquatic products production in this region is still very great.

Reasons for impairment of rapid development of aquatic productions output are as follows: (1) Some places only catch but do not hatch. This plus the antiquated fishing equipment used makes for a low labor productivity rate. (2) In the growing of fish in ponds, fertilizer and fish food does not suffice; promotion of scientific fish raising is poor, and intensive raising of fish cannot be realized. (3) Fish varieties are inadequate. Fish varieties that weigh a lot, in particular, do not satisfy demands of all places in raising fish. In Liyang and Jintan counties, for example, where numerous water surfaces are used to raise fish, yields average only 10 to 20 fish per mu, and these are both small and low in quality. In some places the death rate is high from summer stocking of ponds. (4) Insufficient protection is given the breeding of fish and shrimp resources in streams and lakes. The relationship between agriculture, and fishing is not well managed in some places with the result that spawning of some species and the living places for small fish and shrimp are damaged. Improper fishing equipment and fishing methods are recklessly used in fishing. When locks and dams are built along lake outlets, the spawning route for some fish species is cut. Urban pollution and agricultural pesticides also cause damage to some fishing industry resources. (5) In some years natural disasters such as typhoons and torrential rains cause fish to leap free from the water. Contagious diseases in fish also impair output of aquatic products.

The main ways in which this region can further develop aquatic products output are as follows:

1. Hastening realization of socialist reform for fisherfolk to make the most of the superiority of the collective economy. Though a program of "taking grain as the key link in all around development," the conflict between agriculture and aquatic products in the use of water surfaces can be satisfactorily handled. In fish raising areas, a mentality of emphasis on farming and

slighting of fishing must be overcome, with proper provisions made for fishing industry production. In streams and lakes where waters are deep, there are numerous inlets and outlets, waters are not rich in fish nutrients, and conditions for breeding of fish are poor, provision can be made for the growing of aquatic plants, the water surfaces being used without mutual conflict for catching, hatching, and the growing of plants.

2. Gradual decrease in taking catches without doing anything to build up water surfaces, expanding the raising of aquatic products to increase yields per unit of area. There must be planned step by step intensive raising of fish with the building of fish ponds that produce consistently high yields. Active increased development of sources of fertilizer and food for fish, improvement in fish raising techniques, strengthening of quarantine and prevention and control of fish diseases, and doing a good job in management of fish raising. Raising of fish in ponds, streams, and pools must be made a part of farmland capital construction plans for the building of aquatic products production bases.

3. Building of fish fry breeding bases to increase output of superior kinds of fish that meet fish raising needs in terms of quantity, specifications, and varieties. There must be planned production and efforts made to improve artificial hatching techniques and the survival rate for fry, and to lower costs. In raising fish along rivers and in marshes, heavy fish varieties must be grown. Places that raise fish in ponds should raise both large and small fish.

4. Improved protection for the breeding of resources for the natural fishing industry. There is need for study of the spawning relationships for fish varieties in the Chang Jiang, in inland streams, and in lakes so that locks can be opened into rivers to permit fish to enter and leave. Fishing equipment and fishing methods that interfere with the spawning of fish should be limited or outlawed. In various lakes and designated rivers and lakes prohibited areas and prohibited seasons for certain fishing equipment and fishing methods should be established. Attention has to be given the handling of urban, industrial and mining toxic waste water to prevent increase in pollution of natural rivers and lakes.

5. Need for adaptation of general methods to local situations for development of aquatic product production. Rivershore and high plain river and pond fishing and fish raising areas must do major water conservancy construction and proceed from a foundation of solution to the problem of water sources to improvement in fish raising conditions, changing negligent habits in raising fish to increase yields per unit of area. In the Tao and Ge lake fishing areas, protection of lake resources should include improvement in fishing techniques and increase in the area where fish are raised. In the mouth of the Chang Jiang canal and pond fishing area, specialization in fishing should be increased with establishment of a fish raising corps and the study of spawning patterns of fish varieties so that gates on rivers along the Chang Jiang may be opened periodically to permit young fish to pass. On water surfaces not suited to the raising of fish, energetic efforts should be made to grow aquatic plants. The high yield pond fish raising area of Wuxi should

expand the building of consistently high yielding fishponds, grow superior fish varieties on a large scale, be vigilant against fish diseases, and establish fish food production bases. The Lake Tai fishing area should do all around planning taking all factors into account for overall lake production, intensify work in breeding and protecting resources, designate fishing, snail, and water grass raising areas, and rotate fishing in different areas at different times. Lake shallows should also be used for the raising of fish in ponds or for the growing of aquatic grasses, the surrounding small lake inlets and river branches being used for the raising of fish in marshy areas. In the Kunshan and Wujiang county lake marsh raising and fishing area, development of the growing of fish in outer marshes has a great future. Kunshan should work mostly at enlarging water surfaces for hatching, and Wujiang and Changshu should work mostly at increasing yields per unit of area. They should build fish production bases and assure needs for raising fish in the outer marshes.

3. Building of Mulberry Groves with Consistently High Yields and Increasing Output of Silkworm Mulberry

Natural conditions of temperature, quantity of precipitation, topography, and soil in the Lake Tai Region are all suited to development of silkworm mulberry production. In addition, the local people have abundant experience in the cultivation of mulberry and the raising of silkworms, and have created an organically linked system of diversified silkworm mulberry, and farm, fishery, and livestock production. For example, mulberry is grown to raise silkworms, and silkworm excrement is fed to hogs. Hog manure fertilizes the fields, and grain husks feed hogs. Hog dung fertilizes mulberry. In this way silkworm mulberry and hog raising and grain production are organically linked in a system that is fairly common everywhere. In the "mulberry base fish ponds" of the Dongting area of Wu County, mulberry is grown on fishpond embankments to stabilize them; mulberry leaves nurture silkworms; silkworm excrement feeds fish; fish dung and pond mud fertilizes mulberry to form a fine system in which mulberry and the fishing industry are linked. In the marshy field area of Wujiang County, mulberry grown on dikes that surround the fields is used to feed silkworms. Mulberry leaves left over in fall and winter, and silkworm excrement are used to grow aquatic plants that are fed to sheep and sheep dung is used to fertilize mulberry. During the "winter dormancy period" for mulberry trees, vegetables are intercropped among the trees. As a result of fertilizing the vegetables, the mulberry trees are nurtured, forming an organically linked system that includes mulberry trees, lake sheep, and vegetables. Silkworm mulberry is suited to collective operations, each production cycle being rather short, and four or five crops of cocoons being raised every year. Capital turns over quickly, not only aiding the country in the building of national socialism and meeting foreign export requirements, but also providing agricultural production sources of funds and organic fertilizer as an important aspect of sideline occupations supporting agriculture.

Nevertheless, silkworm mulberry production in this region has not reached its full potential. Levels of output vary greatly from place to place. In advanced units such as the Eight Production Team, Five Production Brigade in Zhouzhuang Commune, Jiangyin County, the Wangshian Production Brigade in

Zhouzhuang Commune, Jiangyin County, the Wangshian Production Brigade in Yunlin Commune, Danyang County, and the Chenxiang Fif Brigade in Jiaoxi Commune, Wuniin County, silkworm mulberry yields are more than 300 jin per mu, while in some other places yields are less than 50 jin per mu. In recent years the tendency in some communes and brigades has been toward decrease in the mulberry grove area. In the small scale farming economic situation of the past, most mulberry groves were scattered in the middle of grain fields. Consequently, when major efforts were made in farmland construction and fields were leveled, these scattered mulberry groves were frequently dug up.

In future the mulberry field area has to be revived and mulberry groves providing consistently high yields built. Strenuous efforts must be made to develop evenness in yields throughout the region, and efforts made to increase yields per unit of area and area output, all of which will require attention to the following points.

1. Building of concentrated continuous tracts of consistently high yielding new mulberry groves for a gradual restructuring of mulberry growing in places where major efforts are underway in the capital construction of farmlands and the leveling of fields. The experiences of Meicun Commune in Wuxi County in this regard are rather good ones. They made silkworm mulberry production a part of overall agricultural production plans in a program of "no reduction of two and readjustment of one," meaning no reduction in grain growing area and no reduction in mulberry field area, but all around readjustment of mulberry field distribution. They carried out "one concentration, two close-bys, and three reforms," fairly well concentrating scattered mulberry groves, planting new mulberry groves gradually close by the edge of the lake, along river banks and around villages, and using scientific requirements to change sparse plantings to close plantings, to change mongrelized varieties to superior hybrid varieties, and to change tall trunk trees to low trunk trees, building consistently high yielding new mulberry groves that could be irrigated drained, and were convenient for collective, specialized working by production brigades. The experience of Micun Commune can be promoted. At the same time attention should be given to new mulberry grove planning, distribution, and mulberry tree planting pattern to meet future requirements for mechanization.

2. Improving mulberry grove management to increase yields per unit of area. This will require rapid breeding of superior variety mulberry saplings, assured mulberry tree rejuvenation and renewal, filling in of spaces where mulberry trees are missing, planting 400 trees per mu, trimming each tree top into a fist shape thereby getting a total growth of 2,000 branches or more, and producing a total of about 8,000 sub-branches, each averaging 3 chi in length. Intensification of care in nurturing mulberry grove fertility, increasing amount of fertilizaton. Experience in high yield mulberry groves that mulberry leaf yields of 2,000 jin per mu require between 20 and 30 jin of pure nitrogen. Sources of fertilizer have to be actively developed through promotion of green manure intercropping. Vigorous efforts must be made in prevention and control of mulberry tree diseases and insect pests, most particularly mulberry tree capricorn beetles, mulberry weevils, wild silkworms, mulberry locusts, stunting disease, and bacterial diseases to assure consistently high yields over wide areas. It is necessary, in addition to promote superior varieties

of silkworms to boost silkworm cocoon output and quality, to devise a sensible crop pattern for the raising of silkworms, improve management of the feeding of silkworms, pay attention to prevention and control of diseases that cause silkworms to abscess or soften, make major efforts in technical innovations, and improve labor productivity rate.

3. Adaptation of general methods to local situations for development of silkworm mulberry production. The old silkworm mulberry growing area on the Wuxi and Yangcheng flat fields should restructure their old mulberry groves, building consistently high yield new groves to revive their mulberry field area. Lakeshore hilly silkworm mulberry growing regions should plant superior quality mulberry seedlings to replace the old mulberry groves, and also make full use of fishpond embankments for the planting of mulberry trees. Communes and brigades with few sideline occupations should also use drylands, hill slopes, and empty spots in the 10 besides to expand the growing of mulberry groves. Communes and brigades that grow fruit can, in accordance with seasonal demands for labor, make satisfactory arrangements for the growing of both mulberry and fruit. The Wujiang County marshy field silkworm mulberry growing region should actively revive its mulberry grove area, make efforts in replanting missing trees, and improve care of mulberry fields. In places having large areas of mulberry trees, those communes and brigades that face much work pressure can promote small silkworm pit bed or pit room propagation, propagating three times each day or one time each day, propagation of strong silkworms on a mulberry twig, or outside propagation for improved silkworm raising techniques. The Ge Lake flat field silkworm mulberry region can make full use of unused land on both sides of rivers, developing it as mulberry field areas, improve mulberry grove management, improve silkworm raising methods,and improve silkworm raising skills to increase cocoon output. The Lowland field silkworm mulberry region south of Ge Lake can use dike embankments to grow mulberry, and establish fish ponds in shallow with mulberry growing around them. It can enlarge its mulberry field area, increase the ratio of silkworm mulberry, and promote pit bed propagation and outside propagation experiences in the raising of silkworms. The lowlying flat field silkworm mulberry growing areas of Kunshan County, Yu County, and Wu County, where the ratio of silkworm mulberry is fairly small should suitably enlarge its silkworm field area to gradually form a new silkworm mulberry producing area.

4. Adaptation of General Methods to Local Situation for Development of Economic Diversification in Fruit, Tea, and Lake (Hu) Sheep

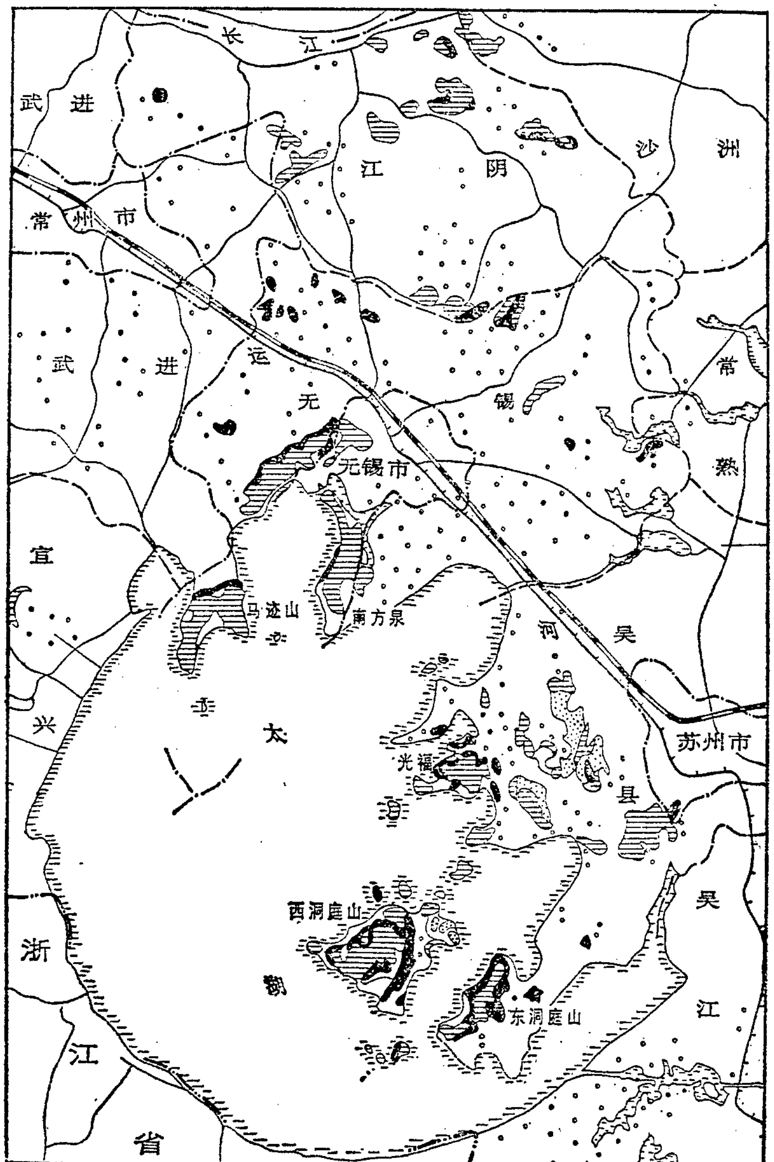
The lakeshore hill area to the south of Lake Tai, including large and small islands in Lake Tai such as West Dongting Hill and Maji Hill enjoy excellent climates resulting from their proximity to the mid semi-tropical belt and to influences from the lake. Accumulated temperatures of more than 5,000°C from temperatures equal to or greater than 10°C, minimum temperature of -8.7°C, rather good moisture conditions, and a relative humidity of 85 percent exist in this area. These low mountains and hills have an elevation of from 100 to 300 meters; valleys between the hills are broad. Foothill deposits and the alluvial layer is rather thick. This is the one place in Jiangsu Province where evergreen fruit trees can be grown. East Dongting, West Dongting, and

Guangfu in Wu County, and Majishan and Nanfangquan in Wuxi grow oranges, loquats, red bayberry and such evergreen fruit trees and have done so for a long period of time. Orange varieties include Zaohong, Huangpi, and Liaohong. Loquat varieties include Zhaozhong, Qingzhong, Xiaobaisha, Fuyangzhong, and Jidanhong. Red bayberry varieties include Xiaoyexidi, Dayexidi, Wumei, Tianshanzhong, and Jichengzhong. There is room for further development of fruit trees in this area. Fruit trees may be grown if both problems with extremely thin soil layers and water sources can be solved. As regards the crop pattern for fruit tree varieties, wherever evergreen fruit trees may be grown, if soil and workforces permit, evergreen fruit trees should be grown to the maximum extent possible. They should be grown both extensively and intensively, for summer crops and autumn crops, and marketed as fresh fruit or as processed fruit. Some hardy fruit trees such as plum, walnuts, persimmons, Chinese chestnut, and ginkgo may be grown on fairly high mountain slopes and on the tops of mountains. Citrus trees should be the dominant kind of evergreen fruit tree grown, with suitable provisions made for loquat, and red-berry trees as well. Since loquats and red bayberries reach market early, they can help slack season supply of fresh fruit. In arranging crop patterns, citrus may be grown in terraced fields on hill slopes where irrigation conditions are fairly good, while loquats and red bayberry trees have smaller requirements for moisture than citrus and need not be irrigated in normal years. Therefore, loquats may be grown in hill slope depressions, and red bayberry may be grown atop hills. Some limestone hills that are suitable for the growing of loquats are not suitable for the growing of citrus, so loquats should be grown there to the maximum extent possible. Sweet juicy peaches are another major fruit of this region, output of which has tended to decline in recent years, and which should be revived and developed. In growing fruit trees, efforts should be made to improve orchard water and soil conditions, to continue improvement of varieties, to strengthen management, and to give attention to prevention and control of diseases and insect pests to further improve quantity and quality.

The hills around the shores of Lake Tai are also suited to the growing of tea, and these hills are the place where the famous biluochun tea is grown. It is of rather good quality and future growing of it should be suitably expanded. In addition, fragrant flower crops such as jasmine, roses, daidai [3782 3782], and white orchids from Suzhou, and cassia flower from Guangfu in Wu County should be properly provided for and care of them intensified.

Lake sheep are one of Lake Tai's special products. They are found in Wujiang, Wu, Wuxi, Changshu, and Kunshan counties, and are particularly concentrated in southern Wujiang and southwestern Wu counties. When lake sheep are kept in barns they fatten readily and their fecundity rate is high. Lambskin quality is superior, and they can help solve some of the meat supply problem. Sheep raising places relatively little pressure on grain, and dry mulberry leaves, hay, and aquatic plants may be used as fodder for overwintering. In future with increase in growing of the "three water crops," lake sheep can be grown everywhere. At the same time attention must be given to improving lake sheep quality and to improving production characteristics.

1) 太湖滨湖地区林桑果树分布图



2) 林地 3) 果树 4) 荒山 5) 桑园 0 5 10 15 20 25公里 6)

图 28

1. Mulberry and Fruit Tree Distribution in Lake Tai Shore Region
2. Wooded area
3. Fruit Trees
4. Barren Hills
5. Mulberry Groves
6. Kilometers

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